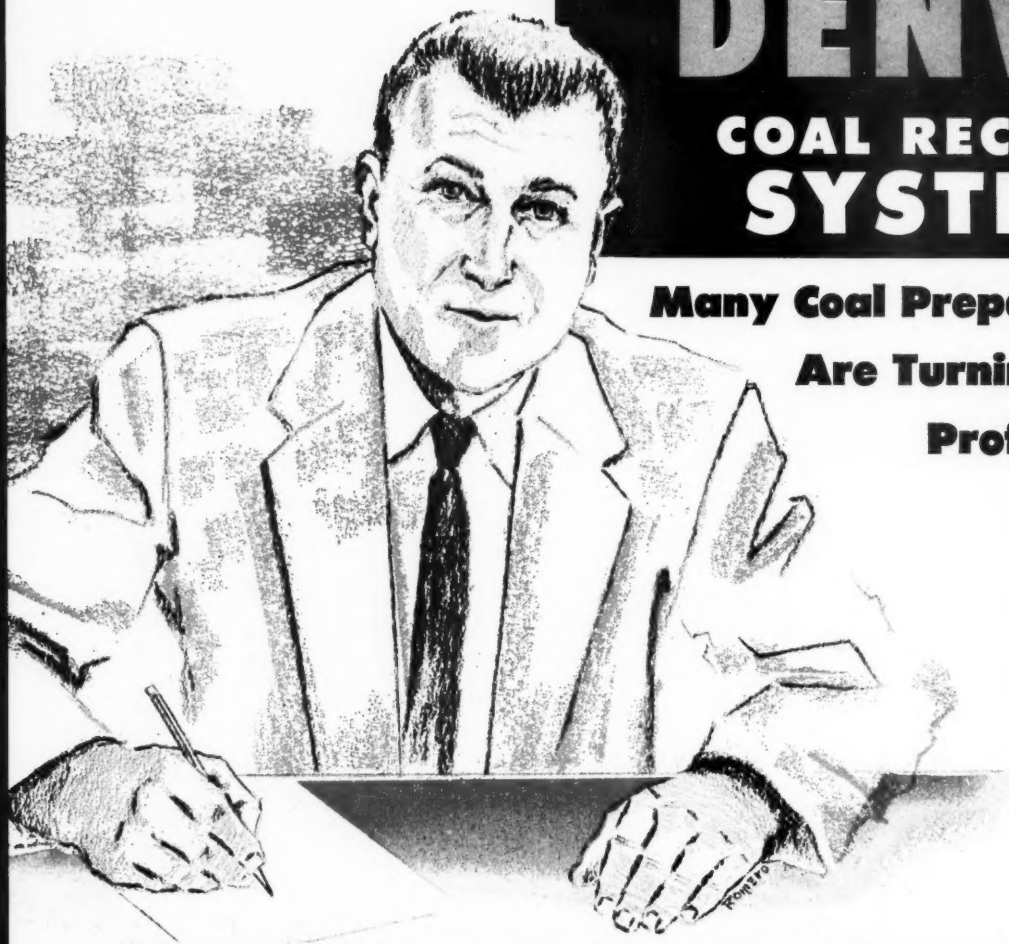
MINING CONGRESS JOURNAL

DENVER
COAL RECOVERY SYSTEMS



Many Coal Preparation Plants Are Turning Waste Into Profits and at the same time . . .

(1) Recover marketable fines from waste water

(2) Remove solids from washery waste and simplify disposal

(3) Reclaim water in a closed water system

Compare This Example To Your Own Coal Preparation Plant:

(A) 1,000 G.P.M. WASHERY WATER IS SENT TO WASTE.

(B) WASTE WATER CONTAINS 10% SOLIDS AT 20% ASH.

(C) SOLIDS REPRESENT 26 TONS PER HOUR AND CONTAINS 84% COAL THAT RUNS 5% ASH.

All washery solids (−28 mesh x 0) are sent to a simple Denver Coal Recovery System which, for this capacity, costs about $86,000 to $90,000, plus approximately $64,000 to $100,000 for installation. (Estimated total approximately $150,000 to $200,000.)

Ash in solids, reduced by Denver "Sub-A" Coal Flotation from 20% to 5%, is blended with coarse coal.

Efficiency of system is approximately 92% and produces some 20 tons per hour of 5% ash coal.

Solids in refuse effluent are dewatered to approximately 40% moisture and conveyed to waste.

Clear water overflow is recycled to plant. Efficiency of closed water system requires only approximately 42 g.p.m. make-up water to replace water lost in clean coal and dewatered refuse.

Total coal fines recovered: 20 tons per hour (280 tons per 14 hr. day) @ $5.00 per ton yields $7000 per 5 day week or $350,000.00 per year.

Operating personnel, overhead and maintenance are low.

The increased coal recovery from the fines should pay for this equipment and installation in less than six months and will accomplish these objectives:

(1) Recover Clean Coal Fines
(2) Remove solids from washery wastes and simplify disposal
(3) Reclaim water and close plant water system.

DENVER Equipment Company can supply you a complete, centralized service on Coal Recovery Systems. Estimates and projections based on reliable laboratory test information are available without cost to you. We invite you to use our experience in the fine coal recovery field. Write today!

"The firm that makes its friends happier, healthier and wealthier"

STANDARD RELIABLE 24 HOUR SERVICE

DENVER EQUIPMENT COMPANY

DENVER 17, COLORADO ... 1400 SEVENTEENTH ST.

MINING CONGRESS JOURNAL

VOL. 45 SEPTEMBER 1959 NO. 9

Indexed regularly by Engineering Index, Inc.

CONTENTS

Opinions expressed by the authors within these pages are their own and do not necessarily represent those of the American Mining Congress.

ARTICLES

Safety in the Mining Organization 30
C. R. Kuzell

Froth Flotation—A Tool for Increased Profits 35
W. L. McMorris, Jr.

Truck Haulage Improvements 38
J. C. Van De Water and L. J. Morgan

Roof Control in Thin Seams 43
Stonie Barker, Jr.

The Ideal Look 46

Selection of Supervisors 48
Harry M. Tibbs

Shaft Sinking at Homestake 52
William C. Campbell

The Economics of Large Stripping Equipment 58
James P. McDowell (Shovels, p. 58)
Lafe Stewart (Draglines, p. 59)

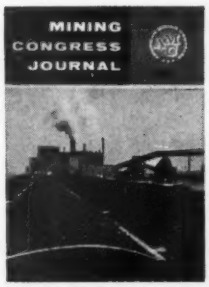
Lower Cost Quarrying Through Automation 64
J. E. Doyen

DEPARTMENTS

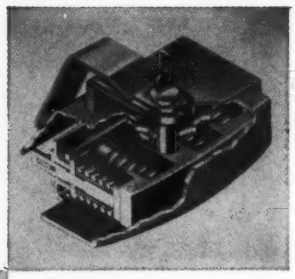
Editorials 29
Wheels of Government 69
Personals 77
News and Views 79
Manufacturers Forum 90

ON OUR COVER

Sheathed in stainless steel, Peabody Coal Company's River King preparation plant at Freeburg, Ill., has a washing capacity of 1000 tph. Large one-pit mines equipped with modern mining and preparation facilities are feasible with today's big stripping machines—all of which adds up to increased efficiency and lower production costs. For complete story see page 58.

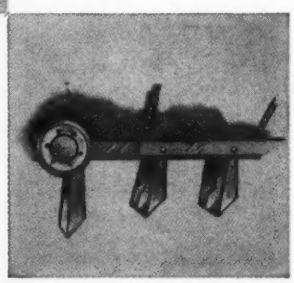


Published Monthly. Yearly subscriptions, United States, Canada, Central and South America, $3.00. Foreign, $10.00. Single copies, $0.75. February Annual Review Issue, $1.25. Second class postage paid at Washington, D. C., and at additional Post Office, Lancaster, Pennsylvania.



acf DOUBLE-ACTION SPRING BUMPER

acf WELDED END SILL MEMBER



acf LUBRICATED DROP-BOTTOM DOORS

acf EXTRA-PERFORMANCE COMPONENTS
increase haulage efficiency

acf LOAD SUPPORT WHEELS

Every **acf** Constant Haulage Mine Car—drop-bottom, end dump, or rotary dump—pays off in extra productivity, lower maintenance costs. No matter what type or size your operations need, from 20 to 30 tons or more, there's a service-proved **acf** design that's right for the job. Why not discuss your haulage problems with an experienced **acf** representative. Just contact the nearest **acf** sales office or write department MC-10.

Write for this bulletin describing all types of **acf** *Mine Cars available on request.*

acf
AMERICAN CAR AND FOUNDRY
DIVISION OF ACF INDUSTRIES, INCORPORATED
750 THIRD AVENUE, NEW YORK 17, N. Y.

MINE CARS FOR CONSTANT HAULAGE.

SALES OFFICES: New York • Chicago • Cleveland • Washington, D. C. • Philadelphia • San Francisco • St. Louis • Berwick, Pa. • Huntington, W. Va.

Du Pont Announces the ACUDET® SERIES of Delay Electric Blasting Caps

Greater Dependability and Accuracy

A new series of delay electric blasting caps with accurately spaced delay intervals which eliminates all possibility of overlapping—a major forward step in delay blasting control.

The new Du Pont Acudet® Delay Electric Blasting Caps provide new standards of accuracy and dependability in regular delay blasting. Manufactured to closer timing tolerances than ever before possible, the new series assures positive intervals of 1/10 to 1/2 second between each period throughout the entire series of 14 delays.

There are 14 delay periods available in the Acudet series with a total spread of 8½ seconds. The timing of each period has been carefully selected in order to provide optimum blasting results.

No arcing failures

The Acudet Series of delays can be fired in series, straight parallel, or parallel series hookups without arcing failures at any voltage commonly used. When the first-period Acudet Delay fires in 1/40 of a second and breaks the circuit, damaging arcs do not have time to form. This eliminates the need for a special circuit-breaking cap in the lead line or for expensive special timing equipment with its limitations.

Field experience with Du Pont Acudet Delays has shown the following advantages:

1. More muck per round—less bootleg.
2. No loose powder in the muck pile—increased safety.
3. Easier loading—more uniform fragmentation.
4. Easier to make primers—Acudet Delays are shorter.
5. Corrosion resistant aluminum shells.*

In common with all other Du Pont Electric Blasting Caps, Acudet Delays are mechanically assembled with nylon plastic insulation on the leg wires, rubber plug closures and shielded shunts.

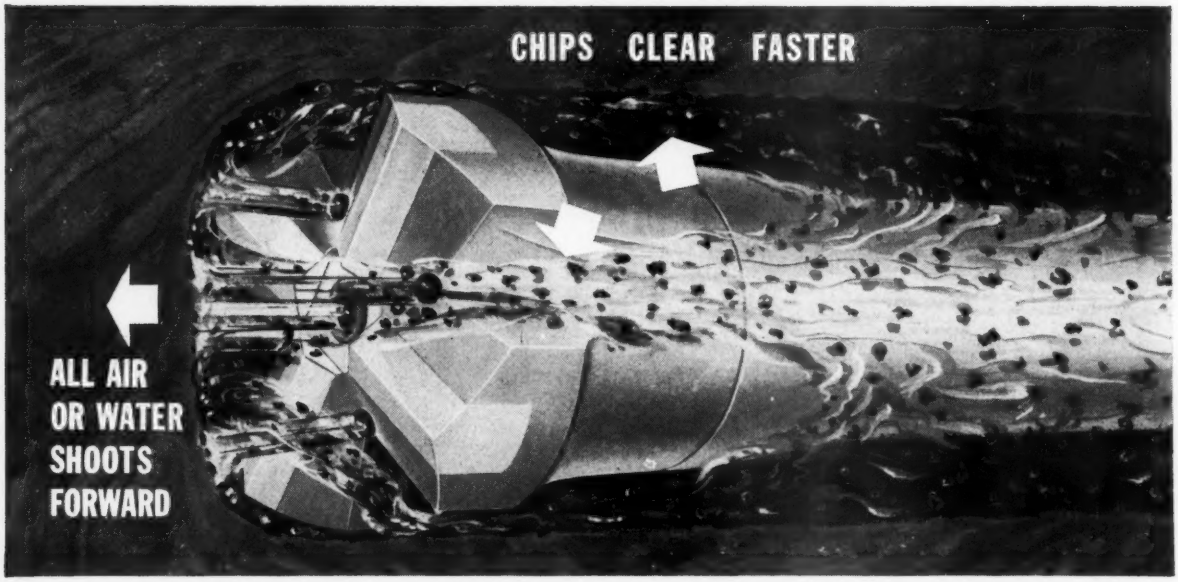
For further information, contact your Du Pont Explosives representative or write to E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Delaware.

**Copper shells on request*

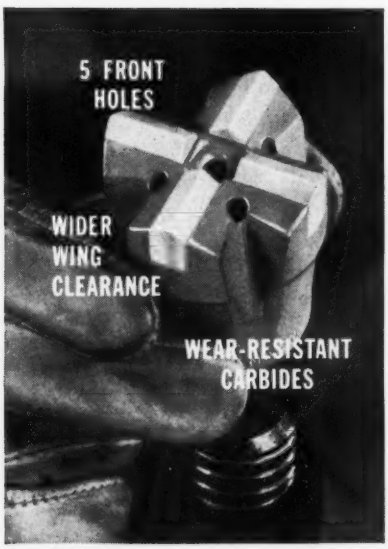
DU PONT EXPLOSIVES

REG. U. S. PAT. OFF.

Better Things for Better Living . . . *through Chemistry*



How the TIMKEN® threaded bit cuts drilling costs on drifters, sinkers and stopers



SPEED DRILLING and cut bit costs with these Timken threaded bit features. 1) Five front holes and 2) wider wing clearance speed chip removal; and 3) wear-resistant carbides give longer bit life.

The action picture above shows how you can cut drilling costs on drifters, sinkers and stopers. The Timken® threaded carbide bit drills more hole-per-bit because two features clear chips faster. 1) Five front holes shoot air or water *directly* against the rock face: and 2) deeper, wider wing clearance lets chips wash back faster. Deeper relief under the heel provides an even freer passage. As a result, the bit spends less time "drilling" chips, more time drilling rock. And removing chips this faster, more economical way eliminates the problem of clogged drill steels, prevents damage to bit skirts.

What's more, the Timken threaded bit has special analysis carbides that give increased resistance to wear and shock. They can be reconditioned many times. And improved thread contact reduces breakage to a minimum.

To get more hole-per-bit, use the Timken threaded carbide bit. For more cost-saving details, send for free brochure. The Timken Roller Bearing Company, Rock Bit Div., Canton 6, Ohio. Cable address: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*

USE THESE TIMKEN BITS FOR OTHER TOUGH DRILLING JOBS

IMPROVED TIMKEN ALL-STEEL MULTI-USE BIT

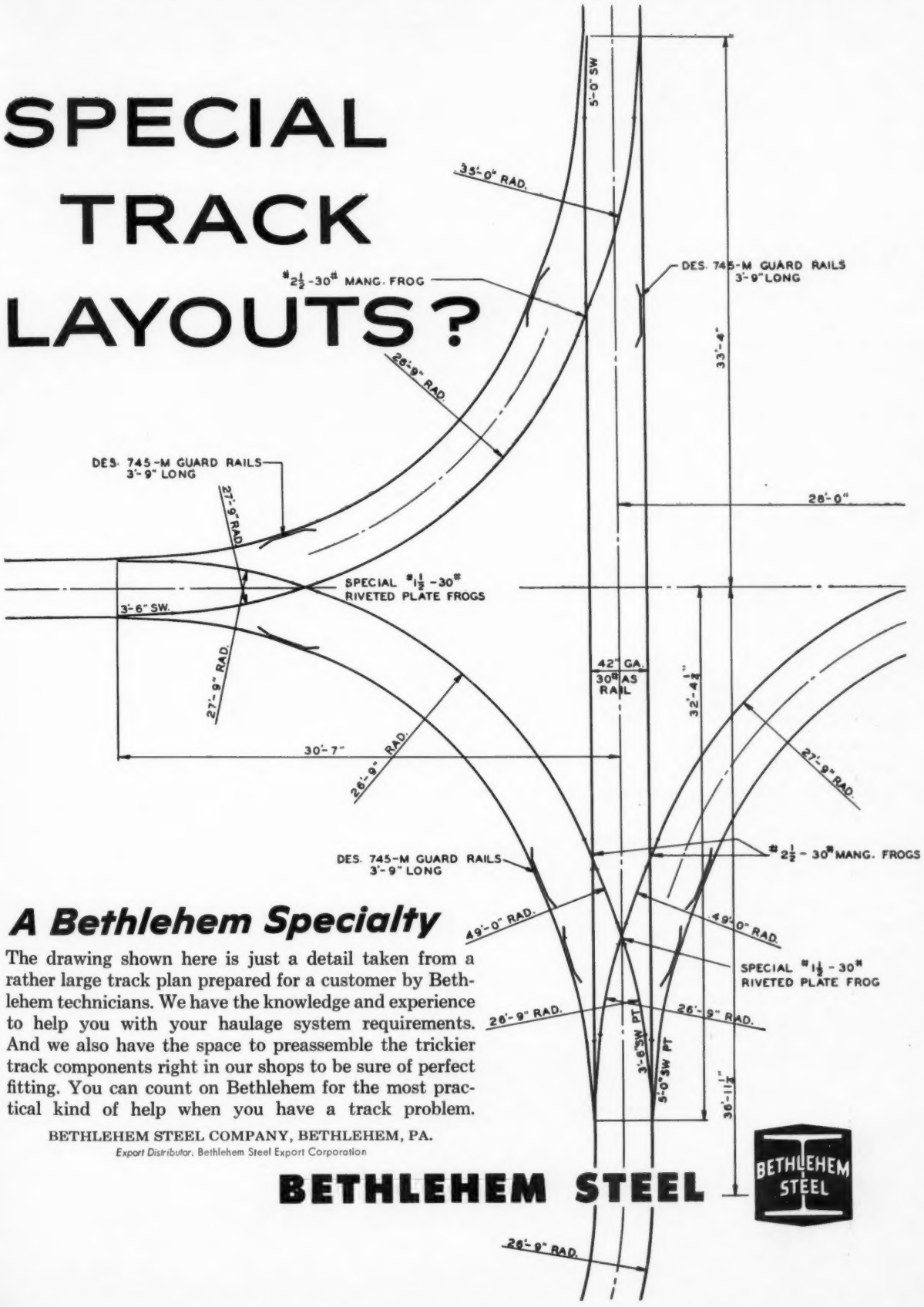
With correct, controlled reconditioning, gives lowest cost per foot-of-hole when full increments of steel are used.

THE AIR-LEG BIT OF THE FUTURE

The Timken tapered socket bit is removable for full steel life yet tapered for one-piece strength. Same frontal features as threaded bit.

TIMKEN® REMOVABLE ROCK BITS

SPECIAL TRACK LAYOUTS?



A Bethlehem Specialty

The drawing shown here is just a detail taken from a rather large track plan prepared for a customer by Bethlehem technicians. We have the knowledge and experience to help you with your haulage system requirements. And we also have the space to preassemble the trickier track components right in our shops to be sure of perfect fitting. You can count on Bethlehem for the most practical kind of help when you have a track problem.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor. Bethlehem Steel Export Corporation

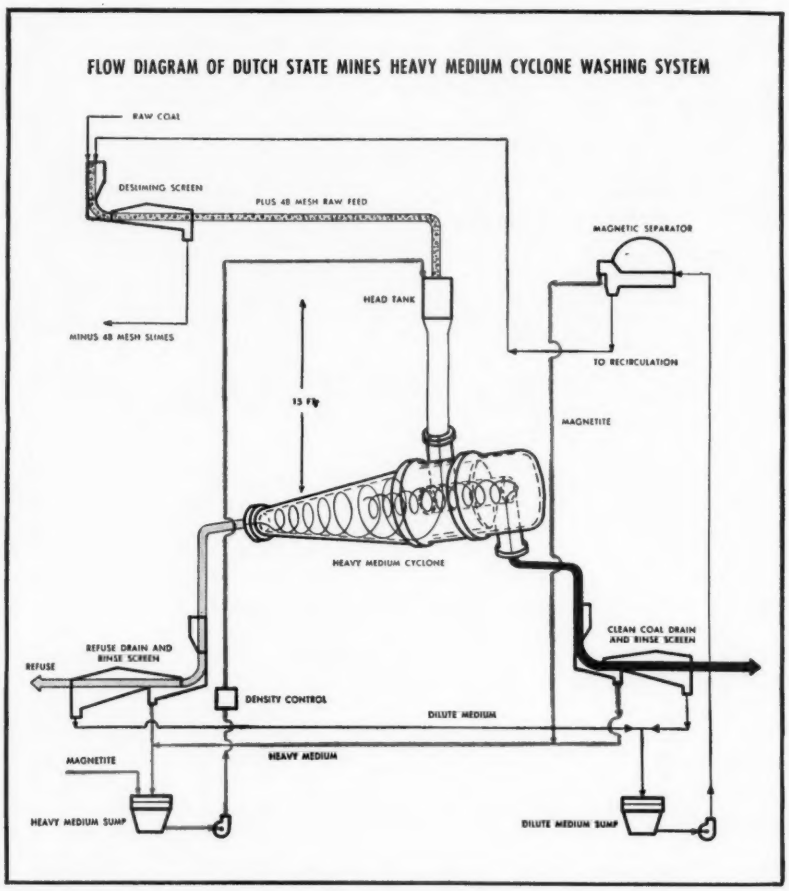
BETHLEHEM STEEL

BETHLEHEM STEEL

CLEANS FINE COAL CLEANER
Than by Any Other Cleaning System

THE DUTCH STATE MINES
HEAVY MEDIUM CYCLONE WASHER
FOR FINE COAL, ¾ INCH TO 48 MESH

- Delivers coal with higher Btu, lower ash.
- Maintains rigid uniformity of quality.
- Obtains maximum recovery of fine coal.
- Washes at any specific gravity you want.
- Operates at highest efficiency regardless of size distribution, particle shape or percentage of near gravity material.
- Produces no measurable degradation of the coal.
- Assures effective specific gravity separation independent of viscosity due to accelerated shearing forces within the cyclone.
- Holds magnetite consumption to a minimum.
- Operates at maximum efficiency through all ranges of capacity.



Now available to coal producers in the United States exclusively through Roberts & Schaefer

Get the full story, from the Roberts & Schaefer engineer, of this significant breakthrough in fine coal cleaning. You can get the advantages of heavy medium cyclone washing by an installation in your present facilities as well as in a completely new plant.

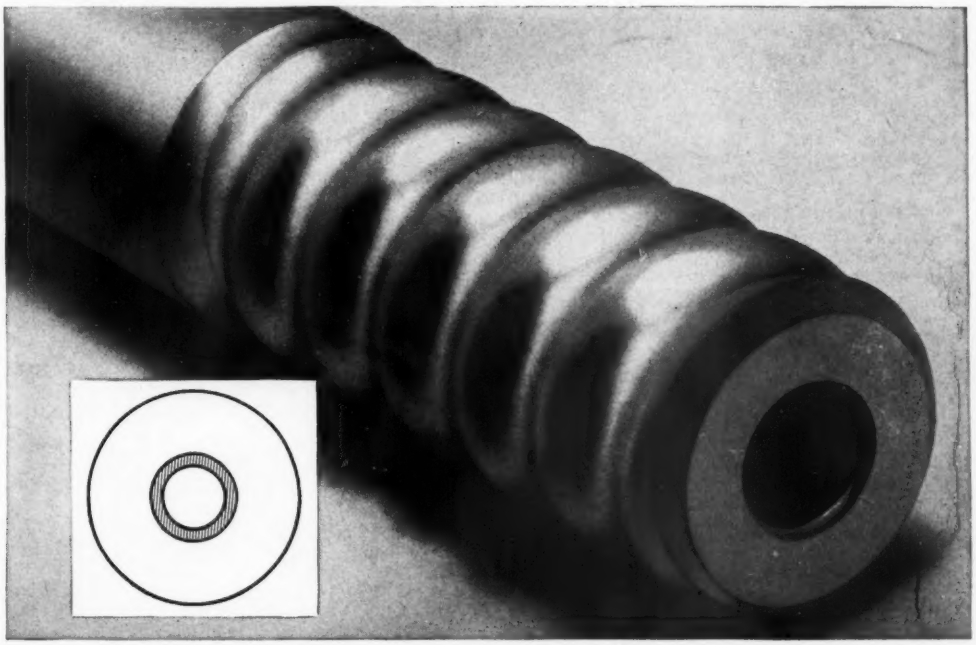
ENGINEERS & CONTRACTORS

ROBERTS & SCHAEFER Company

201 NORTH WELLS STREET, CHICAGO 6, ILLINOIS

NEW YORK 19, N.Y. • PITTSBURGH 22, PA. • HUNTINGTON 10, W. VA. • ST. PAUL 1, MINN.

NEW ROPE THREAD MAKES UNCOUPLING EASY WITH SANDVIK COROMANT EXTENSION STEELS



Rope-Type Threads Afford No Starting Points for Fractures

Connections used in extension drill-steel must be easy to assemble and uncouple, and connections must not become weak links during the actual drilling. Sandvik Coromant's new patented rope thread makes it easy to join and uncouple the equipment . . . yet gives a solid and positive connection. The gently rounded form of this thread means trouble-free performance—eliminates common thread and coupling failures found in "saw-tooth" threads. The complete equipment—bit, rod, coupling sleeve and shank adapter—are all dependable Sandvik Coromant parts made of world-renowned Sandvik alloy steel. A further advantage to the user is that the steel can be re-threaded. Atlas Copco has special literature on Sandvik Coromant extension steel and long-hole drilling, available to you with no obligation. We suggest you write today!

Atlas Copco

610 Industrial Ave.
Paramus, New Jersey

930 Brittan Ave.
San Carlos, Calif.

Distributors of COMPRESSORS, ROCK DRILLS, PNEUMATIC EQUIPMENT, SANDVIK COROMANT DRILL STEEL and CARBIDE BITS

DOW | **Recovery Chemicals Improve Profit Picture**

It is elementary that as a mining company's recovery processes improve, so will the profit picture improve. Difficult separations, concentrations and collections are being solved daily by new and better chemicals. The balance sheet looks better as recovery improves, and these brief chemical notes will help stimulate ideas on making the company's net income bigger.

You may wish to check certain items in this advertisement and forward to those concerned in your company.

ROUTE TO:

_____

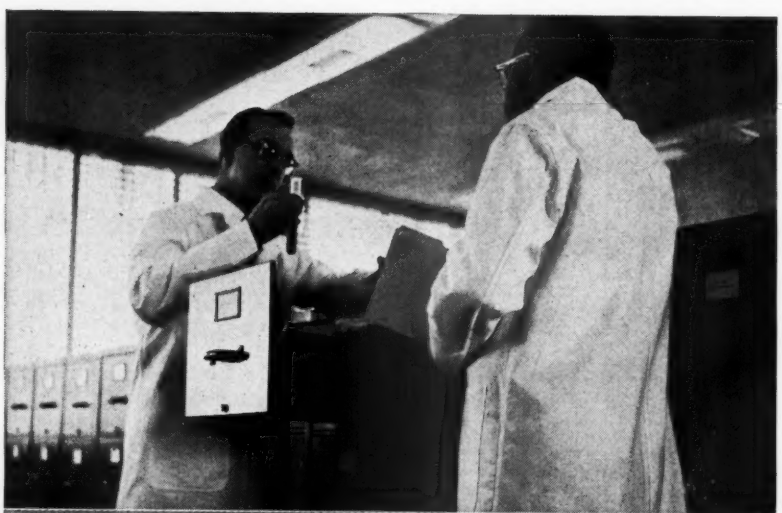
_____

_____

_____

TECHNICAL EXPERIENCE ADDS EXTRA DIMENSION TO DOW FLOCCULANTS

Separan® NP10 and Separan NP20, extremely speedy and versatile high molecular weight organic flocculants, are performing well for the mining industry. As a result, Dow's Tech Service Team has obtained a wealth of information and experience dealing with tricky liquid-solid separations. This experience makes them a willing target for hurried calls from all over the globe.



Vigilant attention to the problems inherent in the processes that use Separan flocculants has given Dow's Technical Service Team a wealth of data and information on flocculation. This collective information has helped solve many a perplexing situation.

Flocculants such as lime, glue and starch have long been used by the mining industry to improve liquid-solid separations. Since new organic materials replaced these substances in the early 1950's, the expert in the new field of faster and more thorough flocculation has been in great demand.

Dow's Tech Service Team has spent a busy five years. As Dr. Herbert Dow, Dow's founder, once remarked, "Chemicals are a good deal like little boys. In the laboratory they act like angels. Outside the laboratory, they can be devils!" Dow knew how Separan flocculants would act in the laboratory, but the key question, of course, was—what will they do in actual field applications?

The answer: Better than the most optimistic dared hope for. But experienced mining men remained skeptical. They had to be shown they would do a better job in their own backyard.

So, from the start, the Separan product was on its own. And looking back over the past five years, Separan NP10 has done its job well while convincing the skeptics. At the same time, this unusual product has also taught the men that went with it a great deal.

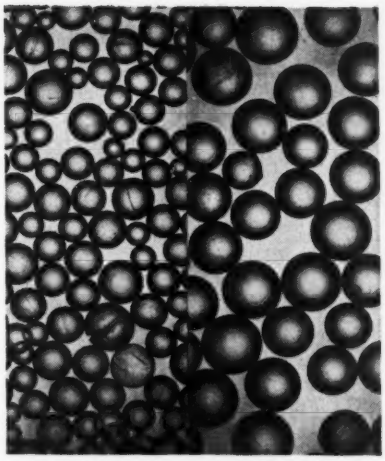
Typical examples of experience. Dow has extensive files on Separan NP10 as used in uranium mills for a variety of difficult liquid-solid separations ranging from clarification of pregnant liquors to the filtration of "yellow cake." The uranium leach problems are, of

course, similar to those of other leaching operations. Gold cyanidation is another process which presents similar problems where Separan finds use. Case histories also are available in settling, thickening and filtration situations in nickel recovery operations. Flotation plants, too, use Separan flocculants for thickening and dewatering concentrate and tailing.

More unique examples. Separan NP10 has been successfully used as an electrolyte additive in the electrolytic recovery and refining of metals. It's also being used for the recovery of flue gas solids in a number of scrubbing plants and in aiding the removal of solids from mine waters before pumping. Clarification of raw river water is another interesting application.

In the beginning, Dow could only offer the product and explain what it could do. Now, five years' experience has taught Dow and many customers just where and how Separan flocculants can improve processes and save precious recovery dollars.

It has often been said you can only learn by doing. And "doing" has surely added another dimension to Separan flocculants. When you need a fast-acting flocculant, call Dow. You'll also get some of the best technical service in the business.



21K 21K RIP

These two ion exchange resins (Dowex 21K and Dowex 21K RIP) lead the way in hard-to-manage recovery situations. Dow's technical assistance plays a major role here.

ION EXCHANGE RESINS crack tough recovery problems

Expensive and hard-to-manage recovery problems are being licked daily by the use of ion exchange resins. Dow has for years made such resins which are sold under the trademark Dowex®. This family of resins has two particular members of most interest to mill men. Both Dowex 21K and Dowex 21K RIP were developed with mining applications in mind. Their properties suit them well for concentrating metals. These two products are particularly well adapted to the treatment of extremely dilute solutions where other processes such as evaporation and precipitation fall down. At this time, they have proved very successful in concentrating uranium. As in the case of Separan flocculants, Dow's technical experience with ion exchange resins adds another dimension to these materials.

NEW MEXICO added to Caustic supply network

Grants, New Mexico, was recently added to Dow's complex system of distribution of caustic soda 50% solution. Basic production is divided among four different plants, and eight terminals in addition to Grants, N. M., provide fast service for this versatile "workhorse" chemical.

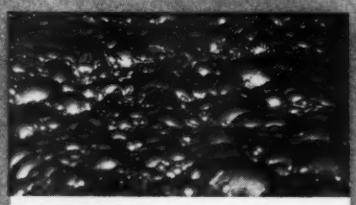
The uranium industry has found profit in using caustic to precipitate uranium from pregnant solution. Other stimulating ideas are to be found in Dow's exhaustive 86-page handbook on Caustic Soda. Copies are immediately available.

★ ★ ★ ★

For further information, booklets, technical papers and other literature on any of these products or others, contact your nearest Dow sales office or write: THE DOW CHEMICAL COMPANY, Midland, Mich., Chemicals Merchandising Dept. 933FX9.

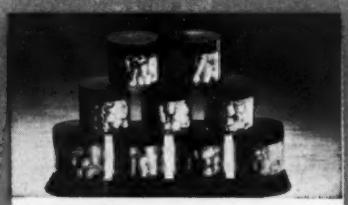
Four more chemicals offer

PROFIT POSSIBILITIES



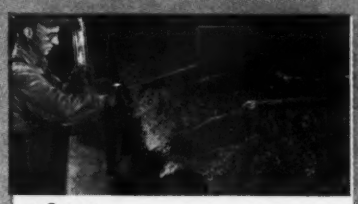
DOWFROTH

Dowfroth® 250 and 400 offer a choice of two products for frothing. Excellent properties: Froth is mobile on the cell and breaks down readily in the launder.



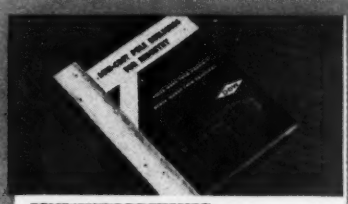
XANTHATES

Nine different xanthates afford mill operators an opportunity to be very selective in their choice of collector . . . indispensable chemicals in the recovery of minerals.



Z®-200

The newest product in flotation reagents. Here's a tailor-made, unique collecting agent for copper minerals and copper-activated zinc minerals where rejection of pyrite is important.



PENTACHLOROPHENOL

New 12 page booklet—"Low-Cost Pole Buildings for Industry"—describes in detail low costs and long lasting benefits of penta-treated pole buildings. Write for copy today!

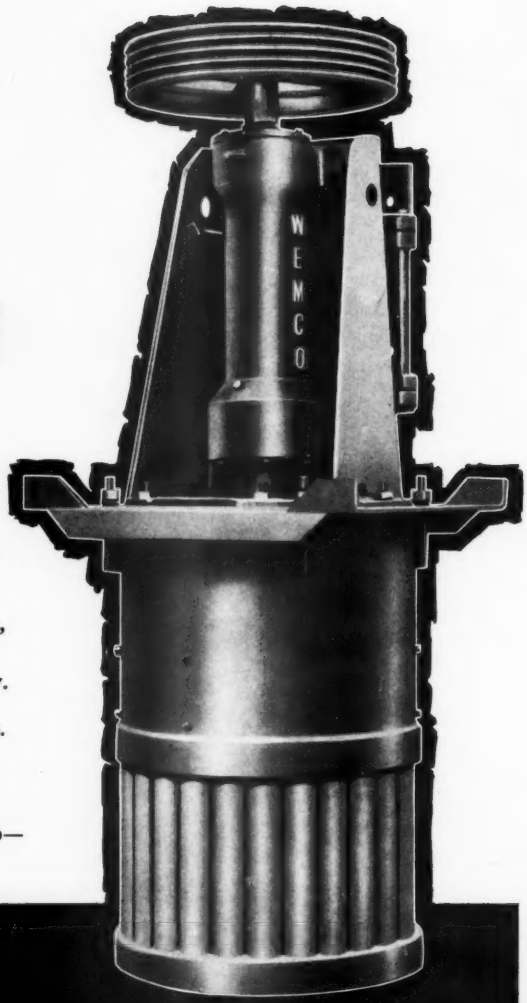
Dow Chemicals basic to the mining industry

Flocculants • Ion Exchange Resins
Preservatives • Chelating Agents
Ammonia • Solvent Extractants
Muriatic Acid • Frothers • Collectors
Chlorine • Calcium Chloride
Alkalies • Flotation Agents

THE DOW CHEMICAL COMPANY
Midland, Michigan

DOW

THIS DECISION WILL PAY BONUS PROFITS OF MORE THAN $6,500 EVERY DAY!



This order and installation of Wemco-Fagergren Flotation Machines by a leading coal producer will result in additional profits of over *$6500 per working day*— and for surprisingly low capital investment. Cost of the total plant addition, including the flotation cells, will be offset in less than four months.

This is another example of how Fags go to work—profitably. Recovery is consistently higher; floor space, maintenance and operating labor, reagent and other requirements are less.

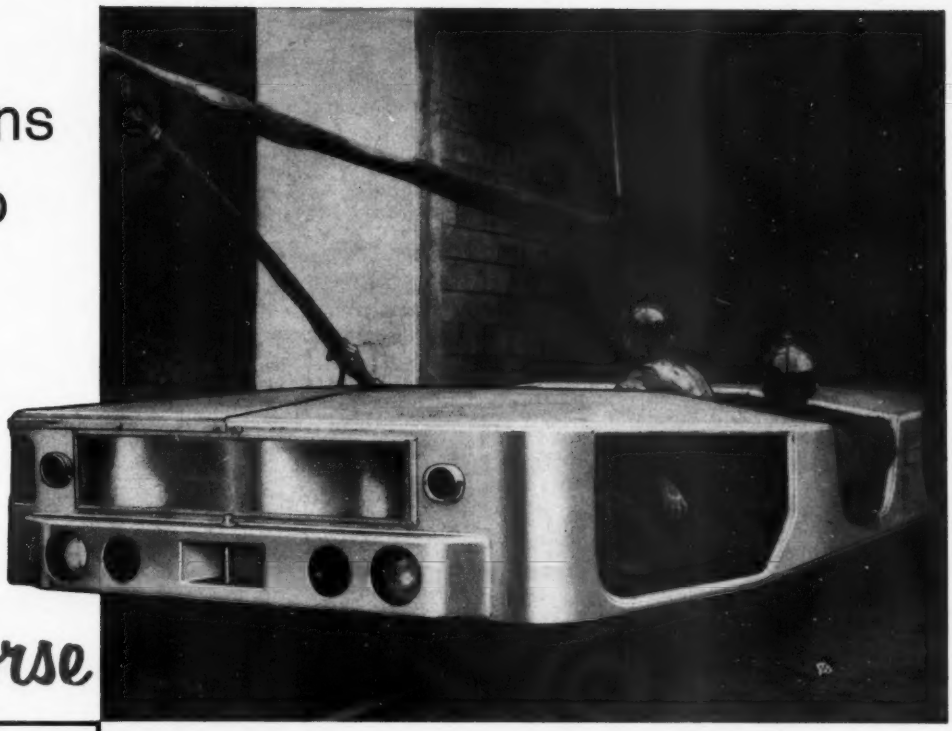
The Wemco-Fagergren record of profit-producing installations tells the story of sound experience. The men of Wemco will be glad to furnish all the facts and discuss why Wemco-Fagergren Flotation will do a better job—where flotation has a place.

WEMCO®

a division of
Western Machinery Company, 650 Fifth St., San Francisco, Calif.
and throughout the world

Reasons why so many mines use the

Lee-Norse



LOW mine portal bus

1. FAST—Cuts portal to portal time as much as 50%.
2. STREAMLINED—Transports 11 to 13 men in safety and comfort in low seams.
3. SAFETY—Exclusive split-roof allows operator full directional vision—trolley pole easily reached. Quick acting hydraulic truck-type brakes on each axle and on the traction gearmotor. Independent mechanical hand parking brake each axle.
4. POWERFUL—Self-propelled by sturdy traction-type 15 HP gearmotor (250 or 550V—DC).
5. RUGGED—Quality built to withstand the hard usage of 'round the clock mining!
6. LOW MAINTENANCE—Simple design—easy accessibility.
7. OPTIONAL FEATURE—Electric dynamic brakes for plus safety on severe grades.

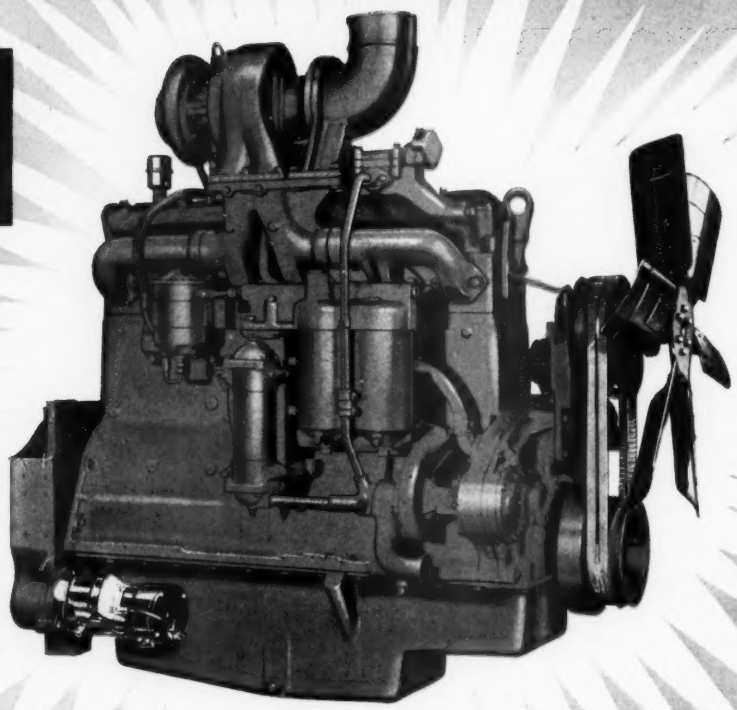
LN

Lee-Norse Company

CHARLEROI, PENNSYLVANIA

Specialists in Coal Mining Equipment

Most economical diesel of its kind



The new Allis-Chalmers 21000 saves up to 3 gallons of fuel in every 10, compared with other diesels.

...has stamina to match

Here's the heavy-duty engine that was tested under full load with half the connecting rod and main bearings cut away. It was deliberately run hot and with only partial lubrication. It was operated with intentionally weakened parts and with imbalances. Its stamina was tested far beyond toughest field use to prove that its great economy was more than matched with ability to take it. Hundreds of field reports show the difference between this great engine and ordinary diesels!

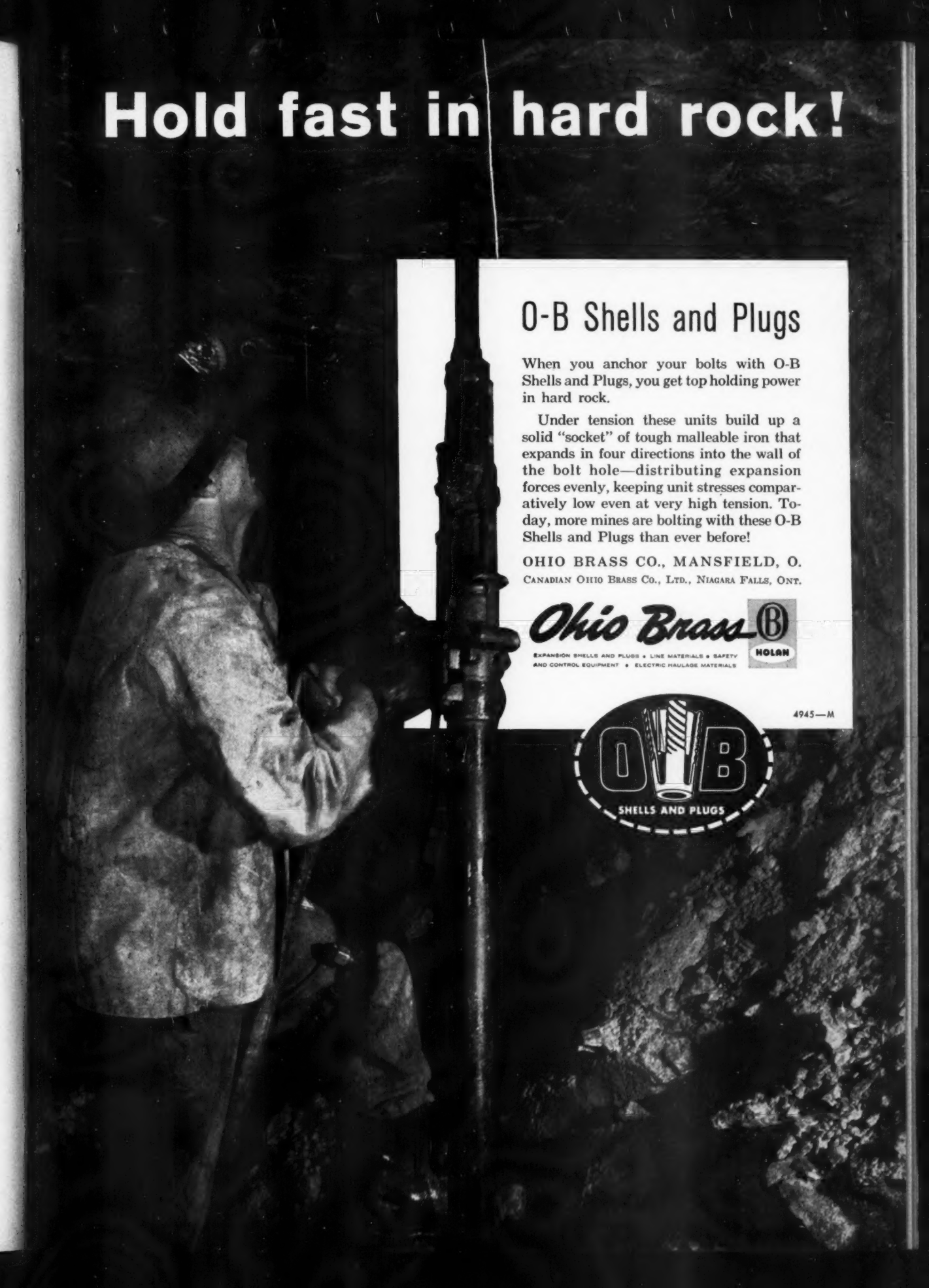
The Allis-Chalmers 21000 and the companion 16000 (naturally aspirated) engines run clean, run longer, because of superior, advanced engineering. Get the story of this modern cost-saving power from your dealer. Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

***POWER* FOR A GROWING WORLD**

BE-17

Hold fast in hard rock!



O-B Shells and Plugs

When you anchor your bolts with O-B Shells and Plugs, you get top holding power in hard rock.

Under tension these units build up a solid "socket" of tough malleable iron that expands in four directions into the wall of the bolt hole—distributing expansion forces evenly, keeping unit stresses comparatively low even at very high tension. Today, more mines are bolting with these O-B Shells and Plugs than ever before!

OHIO BRASS CO., MANSFIELD, O.

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Ohio Brass

EXPANSION SHELLS AND PLUGS • LINE MATERIALS • SAFETY AND CONTROL EQUIPMENT • ELECTRIC HAULAGE MATERIALS

HOLAN

4945—M

O B

SHELLS AND PLUGS

DENVER agitator type COAL FILTER

Modern Filters NEED Agitation

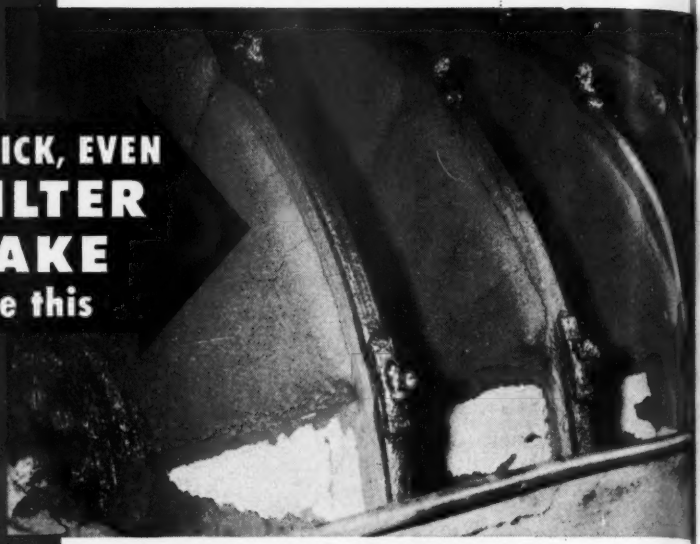
Now...up to 160□′ per Disc...plus

Use the new space-saving filter that's specially designed to dewater coal fines or refuse...that gives exceptionally high, continuous filtration capacity in minimum floor space. Besides higher output with drier cake, you make these important savings: Lower initial cost, lower power consumption, lower maintenance cost.

Submit Details of Your Dewatering Problem

DENVER Coal Filters or complete fine coal recovery and water reclamation systems are available for all sizes of coal preparation plants. Send a sample of proposed filter feed for laboratory filter testing (no cost to you) and complete recommendations such as correct size filter, vacuum equipment and filter media will be sent to you.

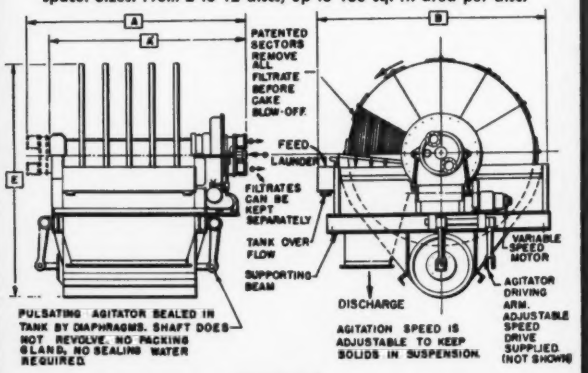
THICK, EVEN FILTER CAKE like this



Tank agitation makes this possible

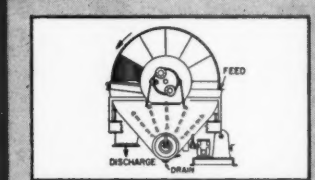
DENVER'S LARGER FILTER CAPACITY

gives greater filter area per square foot of floor space. Saves space. Sizes: From 2 to 12 discs, up to 160 sq. ft. area per disc.

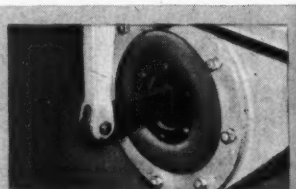


(PAT. PENDING)

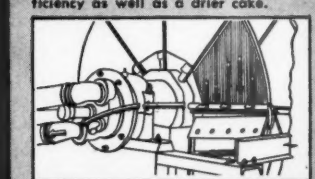
SIZE	AREA PER DISC	A						B	E	HORSEPOWER	
		2-DISC	4-DISC	6-DISC	8-DISC	10-DISC	12-DISC			FILTER	AGITATOR
#75	75 sq.ft	5'-0"	7'-4"	9'-8"	13'-4"	15'-8"	18'-0"	9'-2"	9'-8"	1-2	1-3
#160	160sq.ft	6'-11½"	9'-7½"	12'-3½"	16'-3½"	18'-11¼"	21'-7¼"	12'-11"	13'-8"	½-5	½-7½



SIMPLE. Agitation in the DENVER Filter is upwards from the bottom, keeps solids in suspension. Entire tank is active. Gives uniform cake distribution for greater filter and vacuum efficiency as well as a drier cake.



SIMPLE DESIGN. No submerged bearings, no packing gland, no dilution, no grease contamination. Pulsating unit (patent pending) is sealed in tank with tough rubber diaphragm.



PATENTED GRAVITY DRAINAGE removes residual moisture from filter sector. Prevents blow-back, gives drier product. Vacuum is applied longer—both after and before cake discharge.

VARIABLE SPEED drive gives flexibility in agitation speed and disc speed. Filter speed is easily adjusted to suit your requirements.

"The firm that makes its friends happier, healthier and wealthier"

DECO ENGINEERED STANDARD RELIABLE 24 HOUR SERVICE EFFICIENT

DENVER EQUIPMENT COMPANY

Cable DECO DENVER

Phone CHerry 4-4466

1400 Seventeenth St.

Denver 17, Colorado

NEW YORK CITY
4114 Empire State Bldg.
Phone CH 4-6510

LONDON
15-17 Christopher St.
Finsbury Square
Phone Monarch 3750

JOHANNESBURG
9th Ave. and Broadway
Bez Valley
Phone 25-7531

TORONTO
185 Bay Street
Phone EMpire 3-8836

VANCOUVER
802 Credit Foncier Bldg.
Phone Marine 4918

MEXICO CITY
Avenida Juarez 14, Desp 615
Phone 211477

LIMA
AVDA Orrantia 1570
San Isidro

Has no springs, rides on Hydrair*

— With Haulpak's exclusive air-hydraulic suspension system, you completely eliminate maintenance and repair of springs. 4 Hydrair units cushion against loading and travel shocks . . . keep unit riding level over bumps and holes. LW Haulpak also has exclusive LW power-transfer differential — permits unit to haul over wet, muddy areas that bog down competitive trucks.

You'll haul more tons per hour at lower cost . . . with LW Haulpak®

Low loading height — (only 10'1" on 32-ton size) and large top opening (14'5" x 11') makes it easy to load LW Haulpak *fast*, without spillage.

This revolutionary off-highway truck gives you highest output at lowest ownership and operating costs. You get these profit-making benefits because the all-new, fully-proven LeTourneau-Westinghouse Haulpak is built *specifically* for rugged, heavy-duty hauling. It is not a "beefed-up" highway truck . . . nor does Haulpak have the maintenance problems common on ordinary haulers.

Notice, for example, Haulpak's rugged "V"-shaped body. This exclusive LW design gives you *bonus* yardage within a short wheelbase . . . makes for easy loading . . . and provides a low center of gravity for exceptional stability.

LW Haulpak's short, 130-inch wheelbase gives you unusual maneuverability (makes non-stop U-turn in area only 44'6" wide . . . shortest turning radius of any big off-road truck). You spot, swing around, back up and dump *fast* . . . you eliminate most maneuvering delays, complete faster cycles. You have "feather-touch" power-steer, too . . . system is located high behind bumper, well protected from damage.

And, very important, time lost for maintaining your Haulpak is practically nil. It needs *no* daily lubrication. The entire Haulpak lubrication check — *needed only at 500-hr intervals* — consists of just 4 easily-reached grease fittings. In addition, LW Haulpak's various parts and assemblies — some of them tested and proved by *millions of hours* on LW Tournapulls® all over the world — are much stronger than those used on competitive haulers.

22, 27, 32-ton sizes

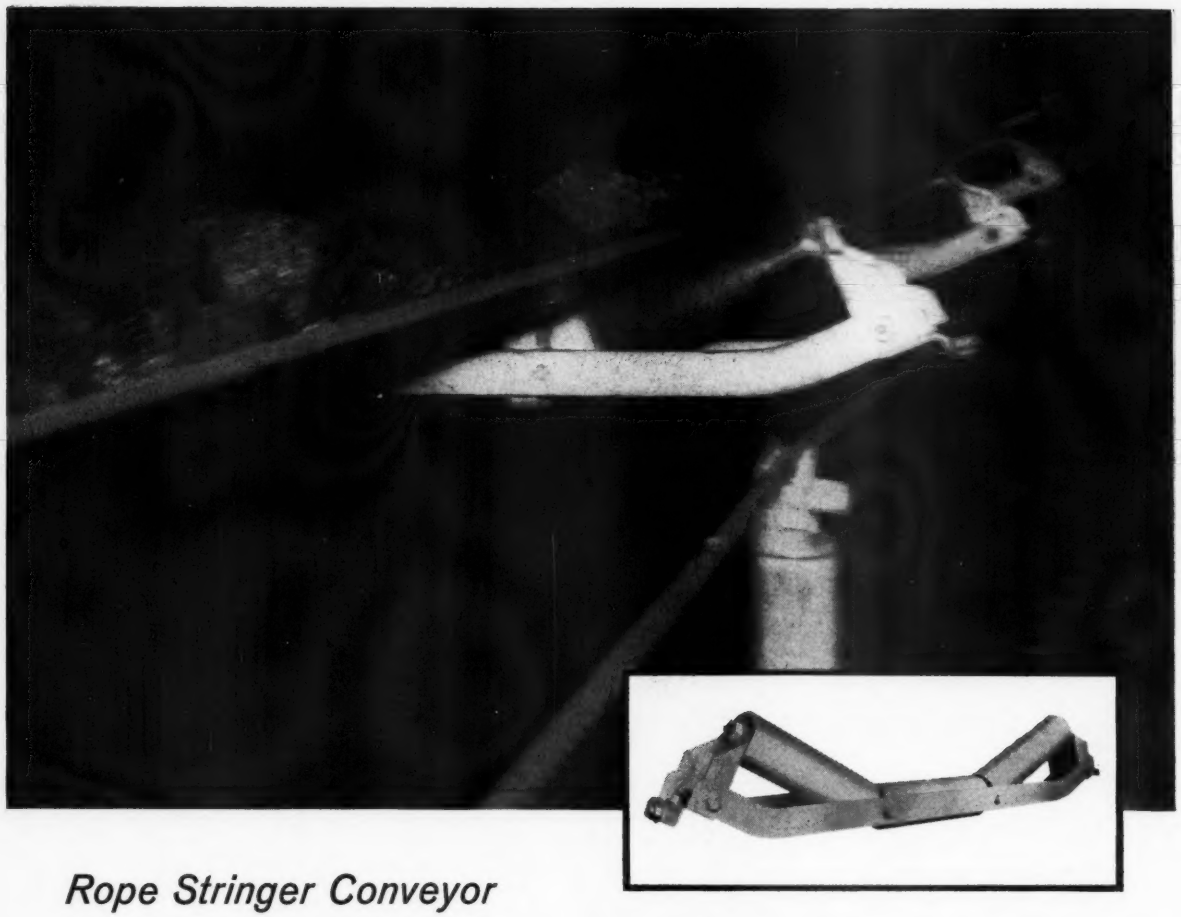
Ask us for detailed specifications on the size Haulpak that fits your needs. Available in 22, 27, and 32-ton sizes . . . 290, 335, and 375 hp. Compare its features with any other truck in the industry . . . you be the judge!

*Trademark HP-2155-G-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



Rope Stringer Conveyor

WITH NEW STYLE L TROUGHING IDLERS

Features:

- High idler frame design prevents belt damage due to runoff.
- Convenient one shot lubrication.
- Positive wire rope attachment with a double nut corner bolt prevents idler movement and belt detraining.
- Easy disassembly—rolls can be removed by loosening just four bolts.
- Idler rolls are interchangeable with one another.
- Under severe service conditions, return belt contacts center roll—not cross members.
- Only one size of wrench needed for all nuts and bolts.
- Full line—2¾" to 5" dia. idlers; commercial or precision roller bearings.

Installation is fast and easy, too. See your local H-R representative or write Hewitt-Robins, Stamford, Conn. Ask for Bulletin 9-15.

HEWITT-ROBINS

THE NAME THAT MEANS EVERYTHING IN BULK MATERIALS HANDLING SYSTEMS...

CONVEYOR BELTING AND IDLERS • INDUSTRIAL HOSE • VIBRATING FEEDERS, SCREENS & SHAKEOUTS • POWER TRANSMISSION EQUIPMENT

H-R Product Manufacturing Plants at Buffalo, N. Y. • Chicago, Ill. • King of Prussia, Pa. • Passaic, N. J. • Amsterdam, Holland • Brussels, Belgium • Genoa, Italy • Johannesburg, South Africa • London, England • Montreal, Canada • Paris, France

Save money when replacing pit tractors...

switch to fast, rubber-tired tractors . . . handle twice the work at half the cost!

When modernizing your pit operations, don't overlook the savings you can make by replacing 2 or more slow-moving track-type tractors with a fast, *rubber-tired* tractor, to handle your scattered pit and road clean-up.

Check these important savings you can make with a modern, high-speed, 218-hp LeTourneau-Westinghouse Tournatractor®:

1. Between pit chores, rubber-tired tractor can handle haul-road maintenance and drainage problems . . . to keep your production units rolling *fast* and *safely*.

2. Mobile, 17.2-mph Tournatractor quickly drives to new areas of operation . . . spends its time working instead of crawling.

3. It cleans up around plant area, dresses and maintains stockpiles.

4. Tournatractor spots rail-cars, tows equipment — reduces costly time waiting for switch engines.

5. If winter snow is a problem, LW tractor with V-type snow plow, or with dozer blade, clears roads, loading and dumping areas — keeps pit operations open and safe in all kinds of weather.

Every tractor assignment — anywhere on your property — can be handled quickly and efficiently by versatile Tournatractor. And, if your pit normally sidelines equipment during its off-season, this mobile LW tractor can be rented out to nearby contractors, counties, or municipalities. It's easy to keep Tournatractor busy all year long!

Try it in your pit

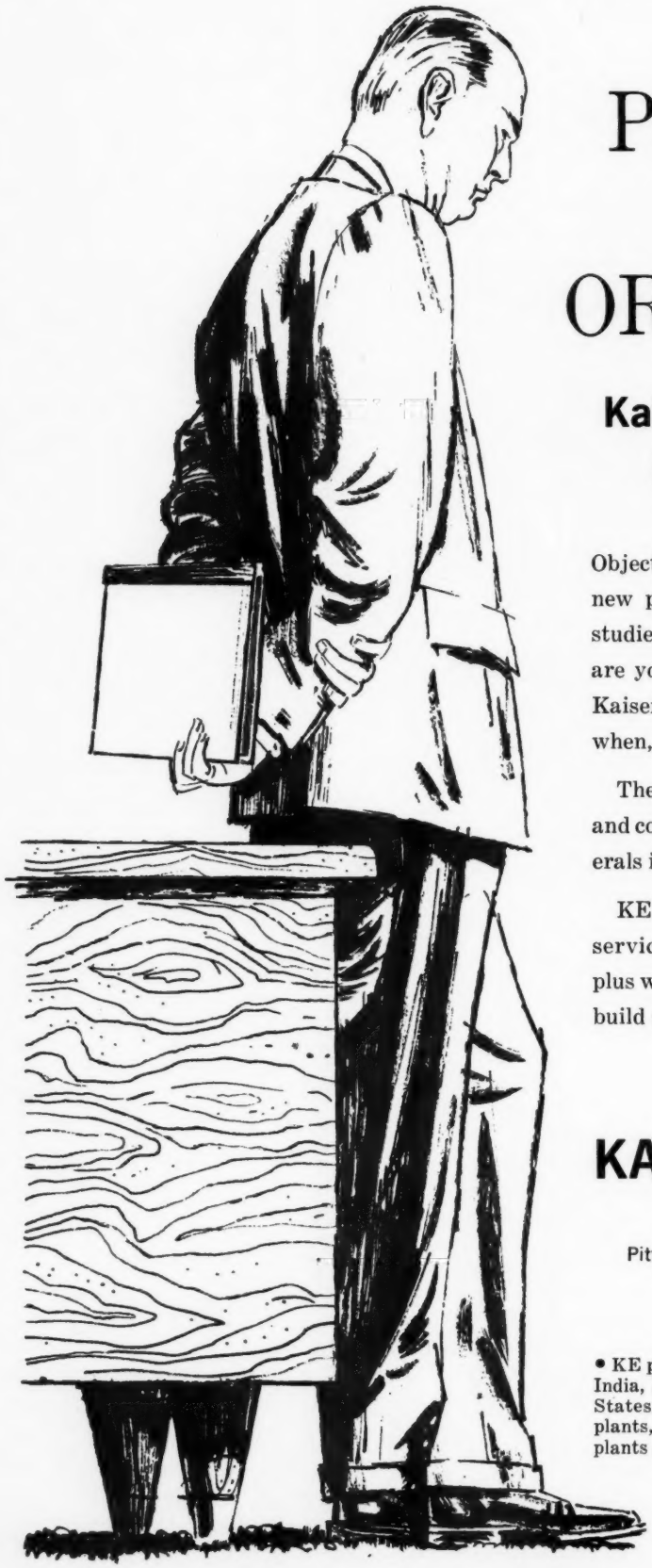
Let us demonstrate a LeTourneau-Westinghouse Tournatractor in your pit. Write or phone for complete information. No obligation.

CT-2138-MQ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



PROCEED, DEFER OR MODIFY?

Kaiser Engineers can help you decide

Objective analysis is vital to sound decision on new plant or expansion projects. Feasibility studies, economic analyses and site evaluations are yours by an outside, impartial firm when Kaiser Engineers is selected to help you decide when, how and where to proceed.

These services are in addition to the design and construction of major facilities for the Minerals industry.

KE offers complete, one-company, integrated service from concept through construction—plus world-wide experience and the ingenuity to build quickly, within budget.

KAISER ENGINEERS

Division of Henry J. Kaiser Company
Oakland 12, California
Pittsburgh, Washington, D. C., Chicago, New York

• KE projects include work in Australia, Brazil, Ghana, India, New Zealand, as well as Canada and the United States. Assignments include iron ore concentrating plants, cement plants, bauxite and alumina processing plants and diatomaceous earth facilities.

5458-M

Proving again and again

LOWEST COST PER TON

of materials handled

National Mine

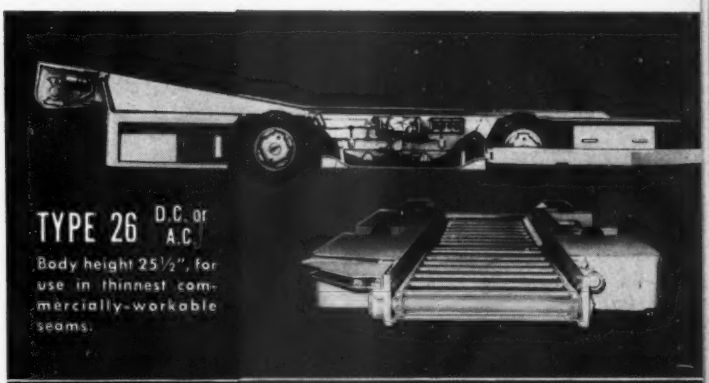
TORKARS

SINGLE PRIME MOVER-TORQUE CONVERTER

Dramatic records for performance and low maintenance are being achieved wherever TorKars are used. TorKars are unique in that they are powered by a single, large capacity motor (or diesel engine) in place of small multi-motors required on conventional shuttle cars. With a torque converter and three-speed forward-and-reverse transmission applying power equally to all four wheels, flexibility of operation is vastly increased, the control system is simplified, service costs are lowered, and high operational standards are maintained.

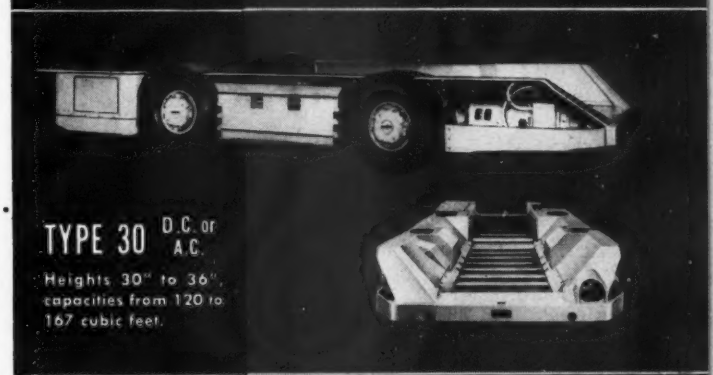
Write *for the informative new TorKar Bulletin and for Specification Sheets on all models.*

The trend is to TorKar



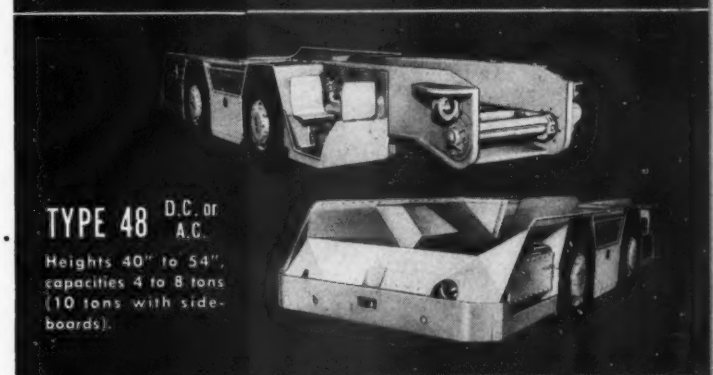
TYPE 26 D.C. or A.C.

Body height 25½", for use in thinnest commercially-workable seams.



TYPE 30 D.C. or A.C.

Heights 30" to 36", capacities from 120 to 167 cubic feet.



TYPE 48 D.C. or A.C.

Heights 40" to 54", capacities 4 to 8 tons (10 tons with sideboards).

TYPE 60 DIESEL

Height 60". Capacity 20 tons. Equipped with patented National Mine Exhaust Gas Conditioner.

National Mine Service Company

DISTRIBUTING DIVISIONS:

ALL-STATE DIV. Logan, W.Va.
ANTHRACITE DIV. Forty Fort, Pa.
BEMECO DIV. Beckley, W.Va.
KY.-VA. DIV. Jenkins, Ky.
MOUNTAINEER DIV. Morgantown, W.Va.
WESTERN KY. DIV. Madisonville, Ky.
WHITEMAN DIV. Indiana, Pa.

MANUFACTURING DIVISIONS:

ASHLAND DIV. Ashland, Ky.
CLARKSON DIV. Nashville, Ill.
GREENSBURG DIV. Greensburg, Pa.

IN CANADA:

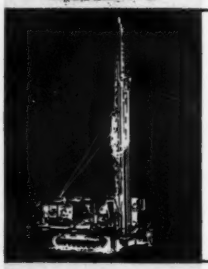
NATIONAL MINE SERVICE (CANADA) LIMITED
Elliot Lake, Ontario

A Constant Standard of Quality in

EVERYTHING YOU NEED FOR DRILLING ROCK

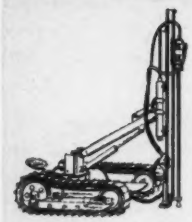
DRILLMASTERS

The most productive and versatile primary blast-hole drill ever developed. Completely self-powered and self-propelled. For rotary drilling or percussion drilling with the revolutionary I-R Downhole drill.



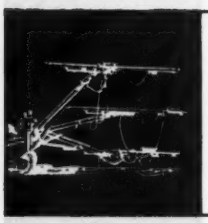
QUARRYMASTERS

The **big** blast-hole drilling rig for heavy-duty service in mines or quarries. Completely self-powered and self-propelled. Can be used as a percussion drill or rotary drill simply by interchanging drill units.



CRAWL-IR DRILLS

The most rugged and completely mechanized crawler drill obtainable. All drill-tower motions hydraulically controlled, converting setup time into drilling time. Tows its own portable air compressor.

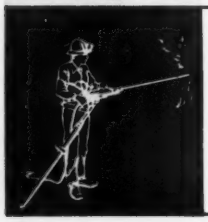


HYDRA-BOOM DRILLING RIGS

Mechanized rock drilling at its rugged best. Heavy-duty hydraulic booms and power-feed drifters for tractor, truck or jumbo mounting. Save manpower—increase production—cut drilling costs.

WAGON DRILLS

Versatile and powerful wheeled units, manually adjustable for drilling in any position. Heavy-duty FM-4 Wagon Drill and light-weight JHM Wagonjack.

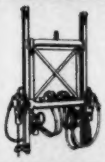


UNIVERSAL JACKDRILLS

The first completely integrated Jackleg drill ever developed. Telescopic feed leg gives full 6-foot feed from an easily-handled 3-foot leg. Five-position throttle and roll-type feed leg valve simplify operation.

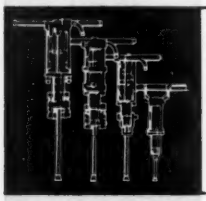
VACUJET STOPERS

The **dustless** I-R stoper drill with built-in jet suction and pressure discharge for fast, clean roof bolting jobs. Only a canvas bag dust collector needed. Use with I-R carset bits and I-R carburized drill steel.



DUAL-DRILL RIGS

Suspended from a side boom tractor, the Dual Drill Rig drills two holes at a time in any trench pattern. Rugged framework mounts dual heavy-duty drifters with long feed. Ideal for pipeline and trench drilling.

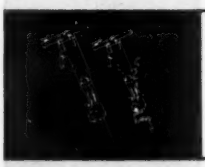


JACKHAMERS

A complete line of hand-held percussion drills. A size, weight and drilling power to meet the specific requirements of any job to best advantage. Known the world over for stamina and dependability.

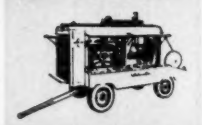
CARSET BITS

The tungsten-carbide insert bit pioneered and perfected by Ingersoll-Rand. High sustained drilling speed in any type of ground. Shoulder drive, bottom drive or tapered socket bits in sizes from 1¼" to 4". Downhole-drill bits from 4¾" to 9".



PAVING BREAKERS

The most complete line of demolition and digging tools available. Six basic sizes, from heavy-duty R-30 slag breaker to light-weight J-10 utility tool. Also a complete line of precision made accessories.



AIR COMPRESSORS

From the world's largest manufacturer of Compressors;—Gyro-Flo portable air compressors from 85 cfm to 900 cfm—Stationary air compressors from 1 hp to 6000 hp.

AIR-LINE LUBRICATORS

Assure proper lubrication for longer life and reduced maintenance of all air-powered rock drills and paving breakers. Operate in any position—automatically feed right amount of atomized oil into air line.

BIT AND ROD SHOP EQUIPMENT

Bit grinders, shank grinders, steel cutters, steel sharpeners and bit and rod furnaces, designed and built by rock drill experts. Everything you need for a well-equipped bit and rod shop.

Your I-R representative is a skilled specialist with wide experience in every phase of rock drilling. Call him whenever you want assistance or advice.

Ingersoll-Rand

5-949 11 Broadway, New York 4, N. Y.

A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR ROCK DRILLING

The Standard of Comparison for FINE GRAIN STRUCTURE

You can see, even without magnification, the finer, denser grain structure of Sheffield Moly-Cop balls. The uniformity, hardness and toughness of this grain structure extend to the very core of the ball. It's the standard of comparison in grinding ball performance tests. And a big reason why you'll get longer service, less down-time, and other important production economies with Sheffield Moly-Cop Grinding Balls.

New steels are born at Armco

SHEFFIELD DIVISION

ARMCO STEEL CORPORATION

OTHER DIVISIONS AND SUBSIDIARIES: Armco Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products

The Mining Machines You'll

YESTERDAY, Marion rail-mounted steamers were the marvel of their era, taking back-breaking labor out of loading and helping giant industries move toward big production.

Field tested, ready and waiting, these are the Marion machines that will help write the next chapters of progress in world mining history.

Teamed with larger haulage units, they cut wider benches, cut track moving time where rail cars are used and open new areas of low-unit-cost efficiency in the pit.

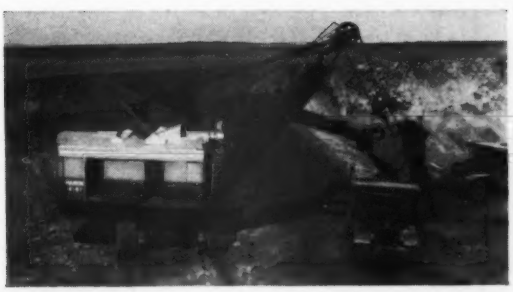
Big, bold and burly, they load more, faster, cheaper.

You get **MORE** *with* **MARION**

Need in the 1960's

The Marion 4161 and Marion 151-M cut open pit mining costs so consistently that they became the standard machines for the industry. That history will be repeated on a bigger scale as the Marion 181-M and Marion 191-M come into their own in the copper and iron pits in the decade ahead.

Far-sighted management men with a reputation for cashing in on the advantages of being the first to adopt new operating efficiencies will want the details about these great new Marions. Let's talk facts and figures.



TODAY, the daily output of Marion 4161 and 151-M machines in the open pit mines sets industry standards for costs. Dependable Marions will continue to mine a big percentage of the world's ore for years to come.

MARION POWER SHOVEL CO. — MARION, OHIO

A Division of Universal Marion Corporation

Rear-Dump "Eucs" have payload capacities of 10 to 50 tons—are powered by engines of 132 to 670 total h.p. . . . have loaded speeds up to 41 mph.

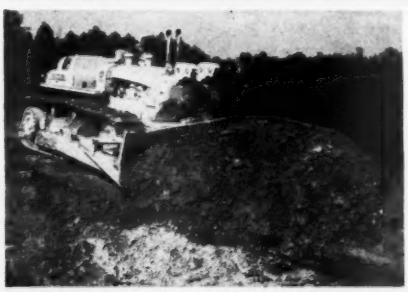
For Lower Hauling Costs in Mines and Quarries Check Euclid Performance

Open pit mine and quarries the world over have standardized on Euclid equipment for moving earth, rock, coal and ore on tough off-the-highway hauls. They know from years of experience on their own operations that "Eucs" get more work done every shift—that production cost is lower than with other types and makes of equipment.

Euclid has a complete range of sizes and models to fit every job requirement — rear dump and bottom dump haulers, self-powered scrapers and the world's most powerful crawler tractor. Your Euclid dealer will be glad to provide a production-cost estimate on your present or planned operations — be sure to see him before you replace or add to your equipment fleet — and have him show you why Euclids are your best investment.

EUCLID Division of General Motors Corporation
Cleveland 17, Ohio

Bottom-Dumps carry 13, 17 and 25 cu. yds. struck . . . special coal hauler trailers have capacities of 25, 40 and 51 tons. Full length, unobstructed door opening make these "Eucs" ideal for dumping free-flowing material into drive-over hoppers.



The TC-12 Crawler has 2 engines and independent track drive . . . 425 net h.p. . . . full power shift . . . top speed of 7.8 mph. This "Euc" tractor has unequalled work-ability for heavy dozing, ripping and similar work in mines and quarries.

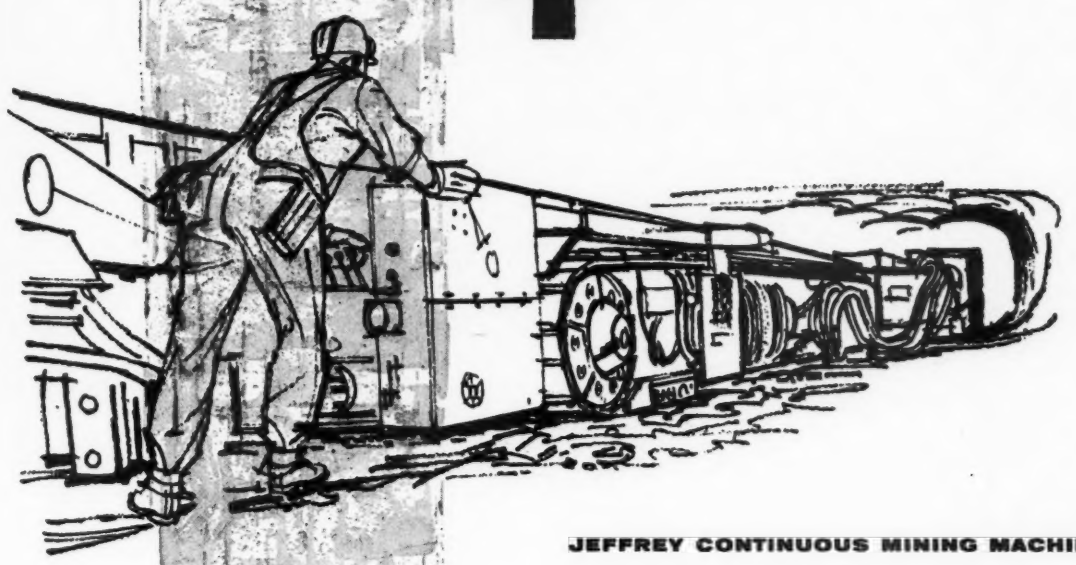
This "Twin" Scraper has 2 engines with Torqmatic Drive . . . all wheel drive permits self-loading . . . struck capacity is 24 cu. yds. There are six other Euclid Scrapers, overhung engine and six wheel types, with struck capacities ranging from 7 to 24 yds.—9 to 32 yds. heaped.

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

choose from 4 types of Jeffrey Colmols®



1 RANGE—Choose from four basic types. Variations within each type give the range that's ideally suited for your operation. You pay for what you need—and that's all.

2 CONTROL—Colmol mining is controlled mining. The operator is in full command, gets smooth, immediate, positive response from electric-hydraulic controls... centralized for convenience, safety, easy access... located so that the operator has an unobstructed view of cutting and discharge operations ... minimum operator fatigue.

3 CAPACITY—Loading rates vary with hardness of coal, impurities in the seam, condition of roof and floor, as well as other factors. Colmol's boring principle of cutting and breaking while advancing in the coal with a minimum of waste motion, assures highest loading rates with maximum face time. Want highest possible tonnage? Then you want Colmols!

JEFFREY CONTINUOUS MINING MACHINES

GENERAL SPECIFICATIONS

	86-A	76-AM	76-BM	76-CM
Maximum mining height	44"	60"	77"	96"
Minimum mining height	28"	38"	50½"	67"
Width of cut	14'-7"	9'-8"	10'-9¼"	10'-9¼"
Minimum tramming height	25¼"	34½"	48¾"	63¾"
Width over crawlers	10'-0½"	72"	77"	77"
Length	34'-3"	29'-5½"	33'-10"	33'-10"
Tramming speed (feet per min.)	22'	20'	20'	20'
Feed speed (inches per min.)	0" to 51"	0" to 36"	0" to 36"	0" to 36"
Electric motors (total HP)	190	150	190	250
Weight—approx. (lbs.)	92,000	56,000	73,000	75,000

Voltage: Colmols can be built for operation on any of the following voltages: 250 V or 500 V, DC; 440 V, 3-ph, 60-cy., or 415 V, 3-ph, 50-cy., AC.

COAL PRODUCTION RECORDS SHOW LOWEST COST PER TON WITH JEFFREY COLMOLS

Get facts now...

Call or write your nearest Jeffrey office

THE JEFFREY MANUFACTURING COMPANY
958 North Fourth Street • Columbus 16, Ohio

JEFFREY

MINING • CONVEYING • PROCESSING EQUIPMENT...TRANSMISSION MACHINERY... CONTRACT MANUFACTURING

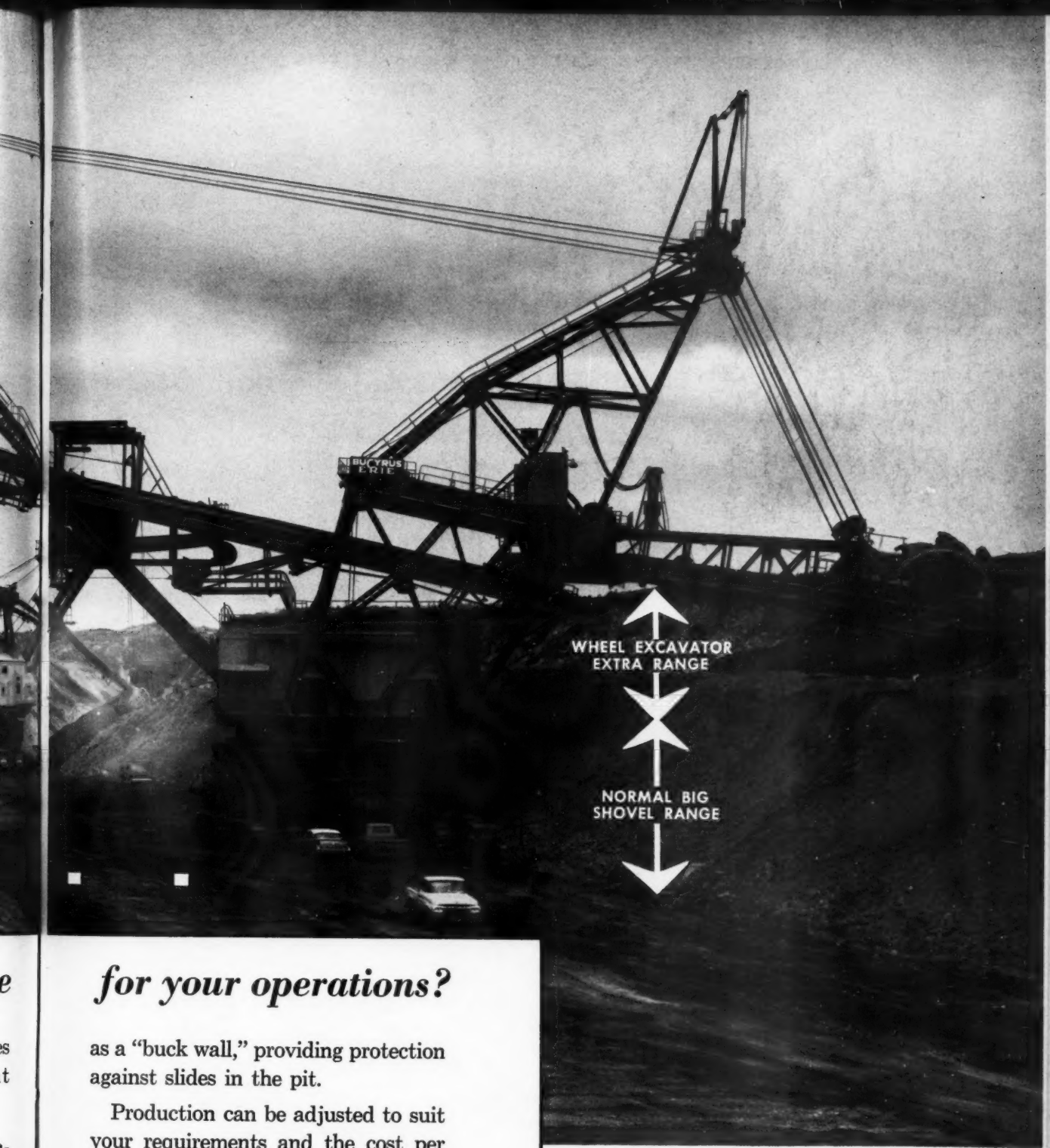
MEET THE WHEEL EXCAVATOR .

. . . have you considered this revolutionary machine

Take a close look at the unique abilities of the Bucyrus-Erie wheel excavator. Perhaps it is the answer to your large-scale excavating, stripping and high-volume dirt-moving problems.

In the coal fields for example, Bucyrus-Erie wheel excavators team up with present big shovels and make it possible to uncover veins previously too deep for practical stripping . . . thereby increasing strippable reserves and extending the use of present equipment.

The "wheel" can deposit the unstable material, normally occurring near the top of a mine cut bank, far back onto the spoil pile. The stripping shovel places the more stable material from the lower part of the bank at the bottom of the spoil pile where it acts



for your operations?

as a "buck wall," providing protection against slides in the pit.

Production can be adjusted to suit your requirements and the cost per cubic yard of material dug is lower than by any other method.

For details on how a wheel excavator may be applied to your operations consult Bucyrus-Erie Company, South Milwaukee, Wisconsin, Dept 5LG.

BUCYRUS ERIE®

Builds Better Equipment

Installed in new type chains, these rugged Kennametal U3RA cutter bits are the answer to rough cutting.

In extreme sulphur conditions . . .

KENNAMETAL* U3RA Bits boosted production and reduced bit cost

Irregular occurrence of sulphur lenses and balls causes a wide variety of mining conditions in the Pittsburgh No. 8 Seam. At one northern West Virginia mine, for example, bit cost for one section was only 1 cent a ton. Yet the mine average was 5½ cents. When they hit severe sulphur nests, the average jumped to 9 cents, with individual sections running as high as 67 cents. Production in those sections had to be stopped until a more economical method could be found.

On 1JCM miners, the company had been using standard carbide bits with a ½" x 1" shank. As would be expected, tip failures occurred more often than in normal cutting, but shank breakage was the big problem.

First, they tried lower cost steel bits with hardfaced tips. This lowered bit cost considerably, but it also lowered production . . . too much to become an accepted answer to the problem.

Next, they tried Kennametal U3RA Cutter Bits. This bit's stronger shank not only reduced shank breakage, but also reduced the frequency of tip failures. Bit costs immediately dropped from 9 to 7 cents a ton. Much time formerly lost for bit changes was converted to operating time . . . and production more than doubled.

Ask your Kennametal Representative or Distributor how Kennametal bits can improve *your* production. Let him help you select and actually test in your mine the Kennametal Bit best suited to your operating conditions. KENNAMETAL INC., Mining Tool Division, Bedford, Pa.

97208

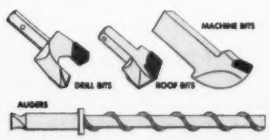
COMPARATIVE BIT PERFORMANCE

Different bits—same section—severe sulphur

	Bits changed per shift	Tonnage per shift	Bit cost per ton
Standard carbide bit	200	225-240 tons	67¢
Hardfaced steel bit	300	175-218 tons	33¢
Kennametal U3RA bit	150	435-652 tons	27¢

*Trademark

INDUSTRY AND
KENNAMETAL
...Partners in Progress



EDITORIALS

ROBERT W. VAN EVERA, Editor

SEPTEMBER 1959

Time Is Running Out

Increasing pressure for clean streams from State and Federal agencies, as well as from various citizen groups, may eventually make it mandatory on mine operators to effectively abate water pollution. Yet, many operators show little concern and tend to ignore or play down the subject. Such an attitude is regrettable as there are indications that time may be running out.

Other industries are being forced to install expensive plants, and municipalities are being made to treat domestic sewage, all in an effort to minimize stream pollution. Now there are growing demands in many areas that the trade wastes discharged from the operations of the coal industry be curbed.

The two major wastes encountered in the mining and preparation of coal are:

(1) Acid drainage water discharged to the stream system. Dr. S. A. Braley of the Mellon Institute states that this "is one of the most serious problems of stream pollution, since there is no known method that completely prevents its forming and no economically feasible treatment after it is formed. The mine acid problem differs from other pollution hazards because acid production does not end with cessation of mining, but actually becomes more evident when pumping is stopped."

(2) Suspended solids in the washery water discharged from coal preparation plants. There are methods available that will remove sufficient of the suspended material to yield a satisfactory effluent.

Some of the current proposals to control this pollution—acid mine water and suspended solids—are so restrictive as to raise serious doubts whether some mines could continue to operate if the proposals were adopted. Let us consider two examples. In order to minimize the acid mine drainage problems, it has been suggested that all openings and cracks to the surface be caulked to prevent the ingress of water into the mine. This, of course, is impractical in most cases. Any plant or mine superintendent, if he knew a feasible way to keep water out of his mine, would be eager to do so if only to reduce pumping costs.

The thought has been expressed that all drainage be discharged at a uniform rate over a 24-hour period so that maximum dilution could be maintained in the stream system. In this way it is also felt that increased stream flow would balance the greater volume of mine drainage that would follow a heavy rain. Unfortunately, the elapsed time between a heavy rain and the inflow underground may vary enormously. Thus it is difficult, if not impossible, to balance drainage from the mine with the stream flow.

The above applies most directly to the coal industry, but anti-pollution legislation would undoubtedly affect also those engaged in mining metals and industrial minerals. The entire mining industry is involved in the general problem.

What can be done about it?

First and foremost, operators must face up to the seriousness of water pollution. It will *not* disappear if ignored. The demand for quality water will increase with our population growth. Operators must realize that there is a problem, and that steps must be taken to alleviate it.

Next, mining companies which have pollution problems should more carefully survey their individual situations and take all practical corrective measures.

The industry should obtain all the pertinent facts. How many operators know the volume of water discharged from their mines, its acidity or alkalinity, and the proportion of chemicals such as sulfates and iron that are in solution? Many companies have no data whatsoever. When confronted with determinations made on samples collected and analyzed by regulatory officials, such companies are not in position to defend themselves. The need for facts is critical, and so far as possible these should be collected on the same basis, employing uniform procedures, which would enable operators to make useful comparisons.

Last but not least, the industry should cooperate with those organizations which are attempting to protect the Nation's water supply. This will enable the mining industry to bring about a wider understanding of its problems and to work for practical solutions.

Sincere efforts now to correct or alleviate sources of pollution may prevent drastic, impractical measures from being passed by State legislative bodies in the future. Solutions to water pollution problems require that the mining industry tackle them boldly—and with sincerity of purpose.

SAFETY in The Mining Organization

"Safety should be the first consideration . . . the safe way is not only the humanitarian way, it is also the most efficient and least expensive way of operating an industrial enterprise."

By
C. R. KUZELL, Director
Phelps Dodge Corp.

THIS paper might very well have been entitled "Short Review of the First Half Century of Organized Campaigning for the Elimination of Accidents in the Mineral Industries." And the year 1958 could almost be called the Golden Anniversary of the initiation of organized safety programs not only in mining, milling, and smelting but also in general industry. 1908 was almost the center of a number of events which really got the movement going. Some of us older men can well remember that the first decade of the 20th Century was dominated to a considerable extent by the personality, vigor, and "Big Stick" of President Theodore Roosevelt. His Republican Administration years were marked by aggressive federal action to deal with social-economic ferments on the domestic scene. Vigorous exposés developed and written up by volunteer "Muckrakers" sought to uncover sore spots in American life and to urge a remedy. Most of us probably know and are proud of the fact that it was a mining and smelting corporation which really got the ball rolling to provide a remedy for industrial accidents. It was the United States Steel Corp. through its top executive, Judge Elbert Gary. According to the manual of the National Safety Council it was the year 1906 that Judge Gary as President of U. S. Steel wrote, "The United States Steel Corp. expects its subsidiary companies to make every effort practicable to prevent injury to its employees. Expenditures necessary for such purposes will be authorized. Nothing which will add to the protection of the workman should be neglected." It would be interesting to check that date in 1906. An article entitled "A Century of Steel Making and a Half Century of Accident Prevention" by Carman Fish, appearing in October 1957 "Safety News", recites that one of the muckrakers, a prominent writer by the name of William Hard, published in *Everybody's Magazine* in November 1907 a very sensational article under the title "Making Steel and Killing Men." Hard justified the title by quoting the experience of South Works of Illinois Steel Co. for 1906, in which year 49 men were killed on the job. He estimated that there must have been 1500 to 1600 additional disabling injuries. This terrific experience had motivated that company to organize for safety, and it has been said that the slogan "Safety First" originated there and was formulated by its Claims Attorney, Robert J. Young.

Up to 50 years ago, and then only for the preceding decade, workmen were able to be compensated for injuries and their beneficiaries for death benefits through employers' liability laws. These put the burden on the victim or his beneficiaries to prove that the company was liable. If the accident was caused by a fellow employee or if it was in the category of a "trade risk" the compensation was nothing at all. As a result, 50 years ago in 1908 the first Work-

man's Compensation Law became effective and it was a federal law to protect civil service employees. This lead was followed by the states and ten of them had Workman's Compensation Laws by 1911. Thus the era of compulsory Workman's Compensation was initiated with the organization for the elimination of accidents. Other noteworthy events which have been potent factors in getting the movement rolling and maintaining its development included the creation of the United States Bureau of Mines in 1911 with its principal emphasis on safety. Also in 1912 the first Safety Congress was held in Milwaukee and it led to the formation in the following year of the National Council for Industrial Safety which was soon expanded to become the National Safety Council.

Following the lead set by Judge Gary, motivated by the humanitarian and social aspects of the problem of injuries and, no doubt, anticipating the penalties of state laws compelling prompt automatic compensation payments regardless of where the blame fell, the other large mining corporations began to organize for safety.

In the Golden Anniversary year of the beginning of the accident prevention movement, it seems appropriate that the writer of this paper should make a brief review of the statistics and the methods used to accomplish the indicated improvement in the record. Because his entire career in mining, milling, and smelting happens to embrace the same five decades, remarks on this subject are based on personal observation and experience coupled with a never-ending desire to participate in or encourage the initiation, improvement, and development of all phases of the program in connection with the mining, milling, and smelting operations with which he has been associated.

"Safety First"

The basic theory and principles underlying a successful campaign for elimination of accidents are actually incorporated in Bob Young's original slogan "Safety First." Although well chosen the slogan was not effectively followed in the earlier plans for the elimination of accidents. It took operators and executives a long time to come to believe earnestly in the literal meaning of the slogan and to actually practice all that it indicated. The author can well remember that many organizations thought they were performing their functions in "Safety First" by training first-aid teams and participating in first-aid contests. About 1911 the writer happened to be one of a large so-called "Safety Committee" at the large works where he was employed and remembers a short initial meeting, but not many follow-up ones for several years. In that initial meeting he received, like others of the committee, a beautiful, color enameled, gold plated lapel button to designate him as a member of the "Safety Committee." The wearing of it was about all he did in those days for the good of the cause. A little later he got to smoke a prize cigar for each month that the record was not too bad. A lot of lip service was given to the slogan but not enough real study to the problem of actually preventing accidents, injuries, and property damage.

Slowly, but surely, operators and executives have come to believe earnestly in the literal meaning of the slogan, "Safety First," and actually have put into practice all that it indicates. The resulting improvement in mining's safety record speaks for itself. Since the "old days" near the turn of the century, prior to organized safety, the frequency rate of life-lost injuries has dropped from about 2.0 to a rate in 1956 of 0.49. (Statistics do not include coal mining)

The most important observation the author has to make, and which sums up all he has to say today on this subject is that it took too many years, decades in many cases and the full half century in a few, to fully appreciate, to believe sincerely, and to practice the principles that: *Safety should be the first consideration, and that the safe way is not only the humanitarian way, it is also the most efficient and least expensive way of operating an industrial enterprise.*

Failure to fully appreciate the principle existed at all the executive, administrative, supervisory, and working levels. Where progress in accident elimination was too long delayed the blame rests more on those in the top rather than on those in the lower levels of the respective organizations.

Statistical Review

The U. S. Bureau of Mines undertook the objective of promoting safety in mining operations when it was organized in 1911. The work of the Bureau from its earliest days involved a well designed, well developed service of "First-Aid to the Injured." This continuing service trains key mining employees in rescue work and any employees of mines, mills, and smelters in rendering first-aid to the injured. The industry and the public have always commended the Bureau for this service.

Through the years, the Bureau has collected statistics on the frequency of fatal and other injuries and has regularly published such findings. It may be true that in the earliest years of this record-keeping there was a lack of standard definitions regarding injuries and the measurement of their frequency and severity. In many instances it was undoubtedly a slow process to elicit full cooperation of the employing company in gathering, maintaining, and making available the necessary data. Therefore, it is the writer's opinion that, although the counting of loss of life has been accurate from the beginning of the Bureau's record, the lost-time injury experience of the industry may have been worse in earlier years than the

Complete committee organization is a most valuable means of two-way communication, but it requires that every man in the organization must attend safety meetings regularly. This not only keeps everyone informed regarding the program, but is also a channel through which considerable safety education can be accomplished.

figures indicate. Be that as it may, it has been of interest to examine the record.

It is a little amusing to make the observation that the experts of the Bureau who have been so meticulous in choice of words, phrases, and definitions for 50 years carried forward the use of the word "fatality" which connotes the mistaken old belief that accidents involving loss of life are a manifestation of fatalism. In those pre-safety days workmen took up employment with the assumption of the risk. It was felt that an accident would catch up with you if you worked long enough, and if you lost your life it was because your number had turned up on the wheel of chance, by the will of Heaven, or by order of the Fates.

Most of the frequency rates tabulated by the Bureau are under the headings of "Fatal" and "Non-Fatal," the former being used for loss of life and the latter for loss of time beyond the day in which the injury occurred. The Bureau has done a grand job collecting and publishing the statistics, and recently it is noteworthy that greater detail for interpretation of the figures is being furnished and more promptly. The reader is undoubtedly aware of these reports. They indicate improvement in the elimination of accidents in all branches of the mineral industry. The writer would like to dwell for a moment only on the accomplishment in one phase of the industry, that of metal and non-metallic mining (except coal mining). In 1911 the Bureau counted 695 lives lost, but in 1956 it counted 81 lives lost. Thus organized safety must have thwarted the will of Heaven or the order of the Fates by preventing thousands of numbers from coming up on the wheel of chance. To be sure, much of the improvement was due to taking some of the hard, arduous manual labor out of mining and also to the swing from underground to surface mining. Only half as many men worked in mining in 1956 as were employed in that industry in 1911. They produced far more with a great reduction in the loss of life, limb, and working time; a great demonstration that safety and efficiency go hand in hand.

Extrapolation of the record indicates that the frequency rate of life-lost injuries in mining must have been at least 2.0 prior to organized safety, but in the past few years it has averaged around 0.6 and in 1956 it was 0.49. The frequency rate in mining only for time-lost injuries was around 110 per million man hours of exposure in the early twenties, but in the past few years dropped to 40 and in 1956 was 30.4. We must not lose sight of the fact that the Bureau's figures are for all mines and the quoted results are geometrical averages. The big point about this is that the mines having good safety organizations have cut down the toll to a much greater degree than these averages. Many underground and open-pit mines have gotten the life-lost injury rate down to 0 for a year or more. Underground mines get the figure for time-lost injuries down towards 20 while open-pit mines frequently get under 10 and occasionally under a rate of 5. The comparison of these rates with the averages makes it obvious that there are still some mines suffering high rates and these are the ones where there is a lack of adequate safety organization.

Fundamental Principles in the Prevention of Accidents

It has been the writer's belief, confirmed by many years of experience, that a program to be successful in climinating accidents must embrace and proceed on honest and sound fundamental principles. Both management and working force must be sold and in agreement that their program shall embrace the fundamental principles:

1. Strong, sincere policy
2. Complete organization
3. Education in safety consciousness
4. Protective measures
5. Statistical analysis
6. Enforcement

As to 1, Policy; the owners, directors, and executives must literally and wholeheartedly subscribe to the principle of "Safety First" and the company policy shall be:

A. To declare its sincere desire to avoid accidents

B. To recognize its responsibility for accident elimination

C. To accomplish safety through the earnest cooperation of management and working force

D. To provide all necessary physical safeguarding

E. To provide all effective methods for the up-to-date safety education, not only of the working force but also of the managerial and supervisory force

F. To exert continuing vigilance in enforcing the program

Likewise, with respect to Policy, the employees must be depended upon to respond wholeheartedly to such a sincere declaration of the company by:

A. Manifesting their desire to avoid accidents

B. Recognizing their individual responsibility for accident elimination

C. Participating earnestly in the program

D. Maintaining and using all necessary physical safeguards and personal protective measures and equipment

E. Developing and constantly practicing the maximum degree of individual safety consciousness

F. Complying individually and collectively in the enforcement and continuous improvement of the program.

Such fundamental principles can be subdivided and elaborated "ad infinitum." A considerable library can now be assembled from published papers, reports, text books, as well as from still, moving, and talking pictures emanating from many sources: Federal, State, local, industrial, educational; insurance carriers, safety councils, and individuals dedicated to the subject. For the purposes of this paper the general outline shown in table I is presented to list the activities which are now considered by many as essential to the successful reduction of accidents:

Table I

GENERAL OUTLINE OF CAMPAIGN FOR ELIMINATION OF ACCIDENTS

I. POLICY
- A. Company Obligation
- B. Employee Obligation

II. SAFETY ORGANIZATION
- A. Committees
  - 1. Employee Unit Committees
  - 2. Unit Secretaries Committee
  - 3. Special Group Committees
  - 4. Supervisory Committees
  - 5. General Manager's Committee
  - 6. President's Committee
- B. Safety Department
  - 1. Director of Safety
  - 2. Services

III. SAFETY EDUCATION
- A. Pre-Employment Indoctrination
- B. Training New and Transferred Employees
- C. Codes of Safe Practice
- D. Other Pamphlets (Rule Books, etc.)
- E. Moving Pictures, Slide Films, etc.
- F. Specialized Training

IV. PROTECTIVE MEASURES
- A. Physical Safeguards
- B. Personal Protective Equipment
- C. Adequate Supervision
- D. Inspections
- E. Suggestions

V. STATISTICAL ANALYSIS
- A. Investigations
- B. Classification
- C. Diagnosis
- D. Research
- E. Remedies
- F. Cost of Accidents
- G. Cost of Program

VI. ENFORCEMENT
- A. Follow-up Procedures
- B. Application of Remedies
- C. Discipline

Space and time limits preclude making comments on the main phases of a safety program. However, it is important that a word or two be said about the Safety Engineer, or Director of Safety as he is sometimes called. Where the organization is big enough, and a Department of Safety is justified, it should be operated as a staff department. The director or engineer in charge of it should be treated as a staff official and not a line officer. The hiring of a safety engineer will not relieve the manager, superintendent, or foremen of their responsibility for the safety of their men and of the plant. That responsibility remains and continues as a line function with the assistance and coordination provided by the safety department in executing the basic policy of the company. It can be a bad mistake to subordinate a safety director to the head of a combined department of personnel, employment, and safety where such department head does not have the stature, skill, and knowledge requisite to fulfilling the duties of a director of safety. Most pitiful are instances in which a management in setting up a safety campaign has appointed a safety engineer who was a more or less wornout loyal employee of long service, probably having made the transfer as a reward and relief to that individual and to make way for a younger, better qualified man to take his place. The chances are that the loyalty of such an individual consisted in his working on emergency repairs through too many nights simply because he didn't understand or practice preventive maintenance. Therefore, he does not understand and can't teach the prevention of accidents; and his loyal services to the company are apt to be overly devoted to first-aid to the injured and the bearing of sad tidings to widows and orphans.

It should be emphasized that complete Committee Organization is a most valuable means of two-way communication and it means that every man in the organization must attend safety meetings regularly. This not only keeps everyone informed regarding the program, but is also a channel through which considerable safety education can be accomplished.

Many activities of the whole program can be successfully accomplished by appropriate application of procedures which are principally technical and tangible in nature because of the inanimate character of the problems involved in such phases. But Safety Education for the development of Safety Consciousness requires the greatest skill. It deals with animate human beings, and the development of safety consciousness in these human beings is the greatest tool for the prevention of accidents. Stanley M. Walker wrote for the U. S. Bureau of Mines an information circular No. 7595 entitled "Safety Consciousness —An Evaluation" published in March 1951 which has had great benefit and influence on mining men in developing their safety programs. He defined safety consciousness as "awareness of hazard and alertness to danger, which controls every action of an individual through his desire to remain alive and uninjured." That definition might well be amended at this date so as to read "through his desire that he, his family, fellow workmen, and fellow citizens remain alive and uninjured." This suggestion emanates from the fact that some mine safety committees have statistically found that men are now safer in a well-run plant than they are in the home and out on the highway and such committees are devoting some of the knowledge they have gained in industrial safety to help in the elimination of accidents in these other fields.

Results to be Expected

Walker, and many others who have been engaged in safety work in the mineral industries, are in agreement that safety consciousness must permeate all levels in an organization. It is now considered indispensable at the management level if good results are to be obtained. Walker in the cited publication drew several conclusions as to the numerical relationship of injuries to the degree of general safety consciousness among the employees including management as follows:

1. At a well-protected plant with safety conscious employees, a frequency rate of less than 2.5 may be expected.
2. Even at a poorly-protected plant, if all employees and officials are safety conscious, frequency rates of 2.5 to 10.0 may be attained.
3. At a well-protected plant, if the workers or officials are not very safety conscious, frequency rates of 10.0 to 20.0 nearly always result.
4. At a poorly-protected plant, if safety consciousness is lacking, frequency rates ranging from 20 to 200 are almost certainties.

The figures Walker used in the above conclusions are, of course, the number of lost-time injuries per million man hours of exposure. Deviations from such general rules can, of course, be expected where there is a wide variation of hazards. We cannot yet expect that scattered underground mining operations, involving a great deal of manual effort exercised in abnormal environment, without close supervision, may enjoy a frequency rate as low as most operations con-

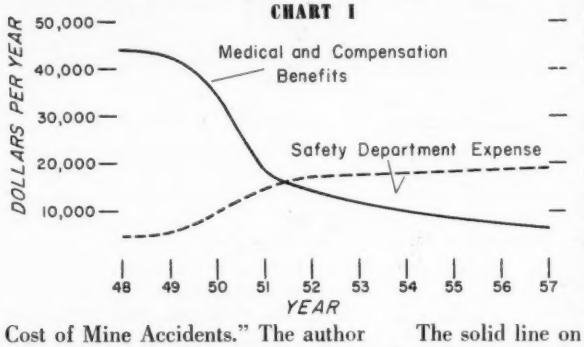
ducted on the surface. Having witnessed the operation of a fully integrated open pit mine, mill and smelter, together with all its shops, power facilities, and administrative departments, go for a whole year at the 2.5 frequency rate, the writer is sure that any management which does not enjoy a result approaching that rate is not detecting and correcting the supervisors and groups responsible for the adverse deviation.

Cost of Preventing Accidents

In the July 1959 issue of *Mining Congress Journal* we had the pleasure of reading an article entitled "The Cost of Mine Accidents." The author will not be infringing on the scope of that paper by having something to say about Cost of Preventing Accidents. Certainly, the expense involved in having men attending the committee meetings, making inspections, investigations, writing and reviewing codes of safe practice, and many other things, is a significant item that has to be considered as a cost of operation. It is also true that when a good degree of success is achieved the cost of prevention is bound to be more than the cost of compensation for injuries. On the other hand, it is certain that if nothing more were done about safety than was done 50 years ago, the cost of compensation under present laws could easily be a hundredfold greater than the cost of prevention, and this statement does not make any allowance whatsoever for the cost of the accompanying inefficiency, property damage, and loss of production.

The ten-year recent experience of a company which adopted, in the earlier part of that decade, the type of program outlined in this paper may be used as a case study. The facts are known and are reliable. The operations are in a state where the schedule of compensation awards is very high. This example is used because in size the plant is in the medium-to-small class ranging from 250 to 300 employees. Its director of safety doubles as director of labor relations. Its work of making corrosive acids and high explosives is certainly a hazardous occupation. The program for elimination of accidents was deliberately adopted and patterned after those which had been demonstrated to be successful in neighboring mines, mills, and smelters. The management at the plant really believed that it had been doing a good job in the safety campaign. However, its methods were obsolete and too much dependence was placed upon a sort of safety policeman who very loyally came out at 5 o'clock in the morning to look things over as the men came to work. True safety consciousness had not been fully realized at all levels. Chart I portrays very dramatically the effect of wholehearted cooperation of everyone in modernizing the program.

CHART I



The solid line on the graph, please note, is not merely the compensation paid for injuries. It is the sum of the medical expense for treating all injury cases, whether they involved loss of time or not, plus the amounts paid by the company to the Industrial Commission of the State as the company's share of the charges to a self-rating group of companies. It is graphed in that manner because it actually represents the dollars of expense that the company was paying out through the period. Actually in the earlier years the estimated liabilities because of accident injuries were about double the amount shown on the graph, the difference being absorbed by the self-rating group of companies. Also, in the latter years of the ten-year period, the liability for injuries was much lower than the graph shows, the difference being a reabsorption by the company of excessive losses in the earlier years and anticipation for some excesses in the future. In other words, the self-rating feature distorted the picture of actual liability for injury experience by partial equalization.

The new campaign for elimination of accidents was undertaken about the end of 1950. Comparing the three years before that time with the seven years thereafter and using the conventionally figured frequency and severity rates, it was found that frequency had dropped 75 per cent and severity close to 100 per cent. But, looking again at the graph, the author would like to point out that in addition to the fact that the liability for compensation was about double the amount which the graph indicates for those earlier years, there were also heavy expenses in approximately similar amounts for property damage and loss of sales. It would not be an exaggeration to say that the total monetary toll of those previous years was quadruple the amount shown on the graph. The line of dashes on the graph indicates the amount of money expended for safety department activities including the salary of the safety director and his office and also including the time charges for the employees when they were attending safety meetings and participating in any other duties connected with the program.

Conclusion

In concluding, it seems unnecessary to point out that a great reduction in personal injury and property damage accompanied by outstanding housekeeping and top-notch efficiency has been the reward of many companies who planned to conduct operations in the safe way. But many of these have found difficulty in eliminating the last increment of injuries. Only a few have been able to keep the rate close to zero for any length of time. Getting the score down to zero and keeping it there will continue to be a problem. Its solution involves the control of human failings such as poor social adjustment, emotional instability, and excessive use of alchol or medications. Some improvement can be expected from better selection and training of the worker. The experts have begun to talk about "bio-mechanics" which connotes appropriate application of both biological and technical sciences to the engineering design of machines in terms of the human capabilities and limitations of operators.

The writer is sure that the old-timers do agree with him that the safe way is not only the humanitarian way but also the least expensive way. We can also well advise the young engineer, operator, or foreman who has not cultivated safety consciousness and a thorough knowledge of the theory and principles of accident prevention that such virtues are now a prime requisite to promotion. One who cannot plan for safety cannot be trusted to plan for top efficiency and maximum yield of the mineral reserves.

Why is there a rekindled and growing interest in the application of froth flotation to the problems of the coal industry?

FROTH FLOTATION / A Tool for Increased Profits

By W. L. McMORRIS, JR.
Director—Coal Preparation and Distribution
United States Steel Corp.

FROTH flotation is a well known means for the concentration of fine mesh minerals, including coal, and has been widely used for approximately 50 years. European coal preparation practice includes flotation in a substantial number of plants. It has been employed in some U. S. plants with success, although the tonnage treated has been relatively small. Today, however, more and more companies are investigating the possibilities of including froth flotation in their cleaning plant circuits.

Many coal producers in the past have avoided the wet cleaning of fine mesh coal because of the added preparation cost and the cost of mechanical and thermal drying which may be needed to meet market conditions. This could perhaps be used as an opening statement for a discussion on the relative merits of wet versus dry cleaning; however, this article will be devoted to the problems of those operators who have elected or will elect to use wet cleaning throughout. The subject of thermal drying will not be discussed, except to note here that without the advances which have been made by the manufacturers of equipment for drying, the wet cleaning and recovery of extreme fines could not be considered as an economical process.

Coal producers who are wet cleaning are facing a number of problems which can be eased in some degree by the better cleaning of fine mesh coal, by the additional recovery of marketable product or a combination of both.

Cost of Recovering Fines vs. Cost of Mining More Coal

First and foremost of these problems is the maintenance of a competitive fuel cost despite rising labor, material and supply costs. More than 50 percent of the coal produced in this country reaches the utility or metallurgical market, and a substantial portion of the coal consumed by these two major industries is reduced to a top size of 1/8 in. or finer before use. While the over-all costs of cleaning fine mesh coal are higher than cleaning coarser coal, in many instances the cost of cleaning and recovering fines which would be otherwise wasted is less than the cost of mining additional raw coal.

Table I shows a sample calculation giving the effect of added yield if fine mesh coal now wasted were to be recovered. These costs are not intended to represent those of any particular mine, but only the method by which added recovery value may be approximated.

Under the 80 percent yield basis, the table shows the cost of producing 3000 tpd of raw coal at $3.00 per ton and the cost of preparation of 2400 tpd at $0.50 per washed ton. The total cost of 2400 tons of washed coal becomes $4.25 per ton.

If it is assumed that 25 percent of the reject loss is recoverable by adding to the preparation plant proper equipment for cleaning and dewater-

ing of the wasted fine coals, a new calculation can be set up for the cost of washed coal. By recovering 25 percent of the original refuse, the total yield becomes 85 percent and the daily output increases 150 tpd and the total cost per ton is reduced to $4.09. As stated before, the cleaning and dewatering of fines is more costly than the same operations on coarse coal. It has been assumed that the preparation cost of fines is three times that of the coarser coals or $1.50 per ton. Bear in mind that if your market can use this coal your total added cost related to the added recovery is only the preparation cost.

Operators who are now wasting some or all of their extreme fines can well take a good look at the recoverable values in the refuse now leaving the plant. Froth flotation is one of the available tools for the purpose and warrants thorough investigation.

Table I. Estimated cost of produced coal

	80% Yield Basis			85% Yield Basis		
	Tons Per Day	Cost Per Ton	Cost Per Day	Tons Per Day	Cost Per Ton	Cost Per Day
Mining Cost	3,000	$3.00	$ 9,000	3,000	$3.00	$ 9,000
Preparation Cost	2,400	$ .50	$ 1,200	2,400	$ .50	$ 1,200
Recovery of Fines				150	$1.50	$ 225
Total Cost	2,400	$4.25	$10,200	2,550	$4.09	$10,425

Disposal of Slurry Poses Problem

Let us look at another phase of the problem of wasting fine mesh coal. Increasing pressure for clean streams may eventually make it mandatory on the operator to prevent any black water from reaching the local watershed.

In many operations involving wet cleaning plants, the disposal of slurry will require ponds such as the one shown in figure 1. This looks relatively simple until the topography of the area on the other side is examined (figure 2).

Thickeners and filters for refuse disposal may minimize the problem in some cases, but these still constitute an added expense without compensating realization. The building and maintenance of slurry basins such as the one shown in figure 3, located at Gary, W. Va., is costly and also fails to provide any offsetting realization of marketable coal.

In some instances both systems are necessary if the requirement for clear waste water is met. The actual tons of slurry which must be taken care of will frequently contain 50 percent or more of recoverable coal. The adding of fine coal recovery to the plant circuit will reduce materially the slurry disposal problem and, as previously discussed, may even show a profit.

There is another phase of the fines problem. Many plants in operation today are recovering high percentages of fine coal without suitable cleaning. To remain competitive with other fuels the delivered cost per 1,000,000 Btu must be kept low. Transportation charges to market are frequently as high as the coal price f.o.b. shipping point. High quality can have an important bearing on marketability for utility coal, and for this reason cleaning fine coal may be very helpful.

Complete Cleaning Important to Metallurgical Customer

What are the needs of "coal's number two customer"—the metallurgical field? The relationship of coal analysis to the cost of producing pig iron is very complex and no attempt will be made to cover the complete story. However, this article will illustrate one of the simplest of the evaluations, that of "effective carbon".

Major elements of the original coal which remain in coke as charged to the blast furnaces are carbon, ash and sulphur. The ash and sulphur must be removed in the furnace slag and the heat required for this reaction is supplied by the oxidation of a part of the fixed carbon in the coke. The remaining fixed carbon is that which is available for the reduction of iron ore. The portion which is available after satisfying the heat requirements of the associated ash and sulphur is termed "effective carbon".

Table II is an approximation of effective carbon on two different assumed coal analyses. The analysis to the left is an example of a coal which has been cleaned only partially, or to

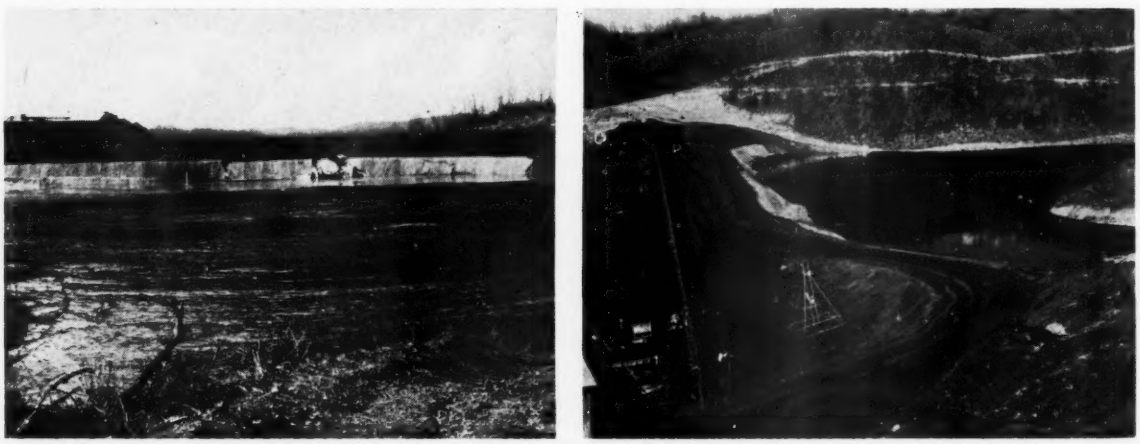


Fig. 1, 2. Increasing pressure for clean streams may eventually make it mandatory on the operator to prevent any black water from reaching the local watershed. In many operations involving wet cleaning plants, the disposal of slurry will require ponds such as the one shown (left). This looks relatively simple until the topography of the area on the other side (right) is examined. The adding of fine coal recovery to the plant circuit will reduce materially the slurry disposal problem and may even show a profit

	Components of Coking Coal (As Received Basis)	
	Partially Cleaned	100% Cleaned
Natural Moisture	4.00%	4.00%
Ash	8.50%	5.50%
Sulphur	1.25%	1.00%
Volatile Matter	30.72%	31.32%
Fixed Carbon	56.78%	59.18%
Blast Furnace Usage of Fixed Carbon—		
For Smelting Coal Ash	8.67%	5.61%
For Smelting Coal Sulphur	3.69%	2.97%
Effective Carbon	44.42%	50.60%
Total Carbon	56.78%	59.18%
PERCENT INCREASE IN EFFECTIVE CARBON 13.9%		

Table II. Effective carbon approximation

express it another way, a coal in which the fines have not been cleaned.

The effective carbon is only 44.42 percent of the total tonnage shipped from the mine. On the right of the chart is shown the analysis of this same coal, but in this case, the fines are assumed to have been cleaned with a lowering of both ash and sulphur with corresponding increases in the amount of fixed carbon. The effective carbon has increased substantially to 50.60 percent, which is an increase of 13.9 percent in the effective carbon per ton of coal shipped.

This simple chart illustrates that complete cleaning is important to the metallurgical customer. It is also important to the coal producer because of improved market acceptance of cleaner coals.

In the concentrating of ores it is frequently necessary to grind the ore to very fine size in order that the mechanical mixtures of minerals are sufficiently broken apart to make a separation between minerals of value and those which are to be discarded. In the washing of coal the usual practice is to minimize crushing and grinding as much as possible to permit the marketing of the highest possible amount of coarser premium priced coals. In many coals, however, the finer sizes if properly cleaned will have lower ash and sulphur content than is to be found in the coarser fractions. It follows then that the best field for improvement in quality of metallurgical coal lies in the cleaning of fine coal or the recovery of clean fine coal now being lost in slurry.

While the fine coal cleaning is admittedly more difficult, it can be done and operators should not overlook the fact that in many instances washability studies will show that yields of coal at a given ash content are higher when the top size of coal is reduced before washing.

Fig. 3. The building and maintenance of slurry basins such as the one at Gary, W. Va., is costly and also fails to provide any offsetting realization of marketable coal

Modern Mining Methods Have Increased Fines

There is still another very important aspect in the problem of fine coal. Modern mining methods, so necessary to the maintenance of competitive fuel costs, have tended to increase the amount of fines in raw coal, and because of the reduction in top size, the degradation in handling through the preparation plant is usually more severe. Where a plant was producing coal ten years ago with good washer yield, little or no slurry problems and a satisfactory product quality, a change in mining practice may have increased the percentages of fine mesh coal to the point that the operation on any or all of these three counts leaves considerable room for improvement.

The conservation of natural resources should not be overlooked. U. S. coal reserves will not last forever. The Nation cannot afford to throw away fuel which can be profitably recovered. Nor can it afford to use high grade coals for less demanding purposes where proper preparation can make this coal suitable for the high grade markets. Years ago European practice consigned a high percentage of minus 28-mesh coal to power production. During recent years millions of tons of U. S. metallurgical coals have been exported to Europe to make up its deficits in those grades. Today, many European plants have added facilities for the cleaning of the minus 28-mesh in order to produce metallurgical coal from that fraction of their product which previously had been burned in power plants. There is no sound reason why the United States needs to be any less careful with its natural resources.

Each individual operator has his own problems of production, cleaning and marketing as well as waste disposal. The degree of preparation must be determined on the basis of the most economical operation to suit those problems. If an operator is not now cleaning fine coal, he may find that it is profitable to do so. If he is wet cleaning fines and has high slurry losses, he may find it more profitable to salvage coal from those slurries. In either case, his engineering studies may well disclose that froth flotation can be a "Tool for Increased Profits".

TRUCK HAULAGE IMPROVEMENTS

On performance and changes in basic design . . .

By J. C. VAN DE WATER
General Superintendent of Mines
Ray Mines Division
Kennecott Copper Corp.

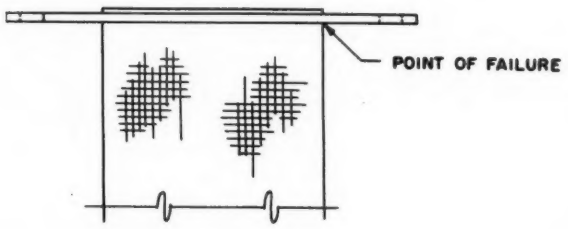
THE writer's experience, in the field of heavy truck haulage has been confined to the open-pit copper mines of the west, and more particularly those of the southwest. Therefore the statements which follow apply to this area and may not necessarily be true for all operations.

Many readers are connected with open pit mining and appreciate the importance of haulage trucks and are aware of the improvements made in recent years. To emphasize this importance, and for the benefit of those who are not actually associated with truck haulage, the author would like to quote a few figures that will illustrate the truck's growing place in open pit mining.

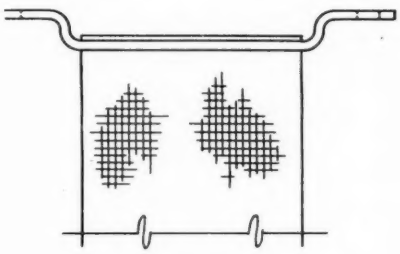
Trucks Make New Tonnage Available

In 1943 at Castle Dome, the first all truck haulage copper pit in the west, there were five railroad pits moving approximately 510,000 tons of combined ore and waste per day. Two of these rail pits were using small fleets of trucks to do pioneer stripping on upper levels, so with

(*Continued on page 40*)



CONVENTIONAL DESIGN



DISHED HEADER DESIGN

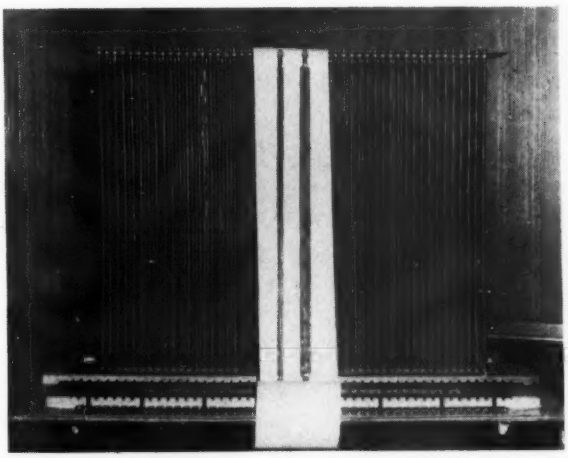


Fig. 1. More horsepower required a cooling system with increased capacity. As core size increased, however, its service life decreased. New designs are being tested to eliminate the two major problems of core failure. A dished or concave header sheet (left) is designed to solve the problem of frequent fatigue failure of the header sheet along the outside row of tubes; and an easily repaired core (below) consisting of individual finned tubes shows promise of eliminating tube failure difficulties

On improving existing equipment at the operation...

By L. J. MORGAN
Supervisor—Mobile Equipment
The M. A. Hanna Co.

THIS subject has tremendous scope. It incorporates anything that lowers the unit cost of moving bulk material and could include operational maintenance or design factors. Normally a paper of this nature deals principally with improvements made by the truck manufacturer on current models, but because of the large increase in initial cost of haulage equipment—some 50 percent in the past eight years—it might be well to talk about improvements that can be made in existing equipment. Today's high costs, which necessitate more care and selectivity in investment, are another major reason for finding improvements rather than retiring the old and buying new equipment. In this respect, periods of recession, such as our economy recently experienced, work to our advantage.

Improvements on Existing Equipment Can Be Made

How can productivity of existing haulage equipment be increased? Several ways. First, more horsepower and a faster cycle time can be obtained by remodeling present engines. Another step toward increasing the units hauled per hour or shift could be to replace the power train to one which is better suited to a particular operation. Pay loads can be increased by enlarging the truck box with side boards and installing extra ply tires. Converting to an optional gear ratio might prove beneficial too. Improvements such as these can be calculated as to their worth for a particular operation.

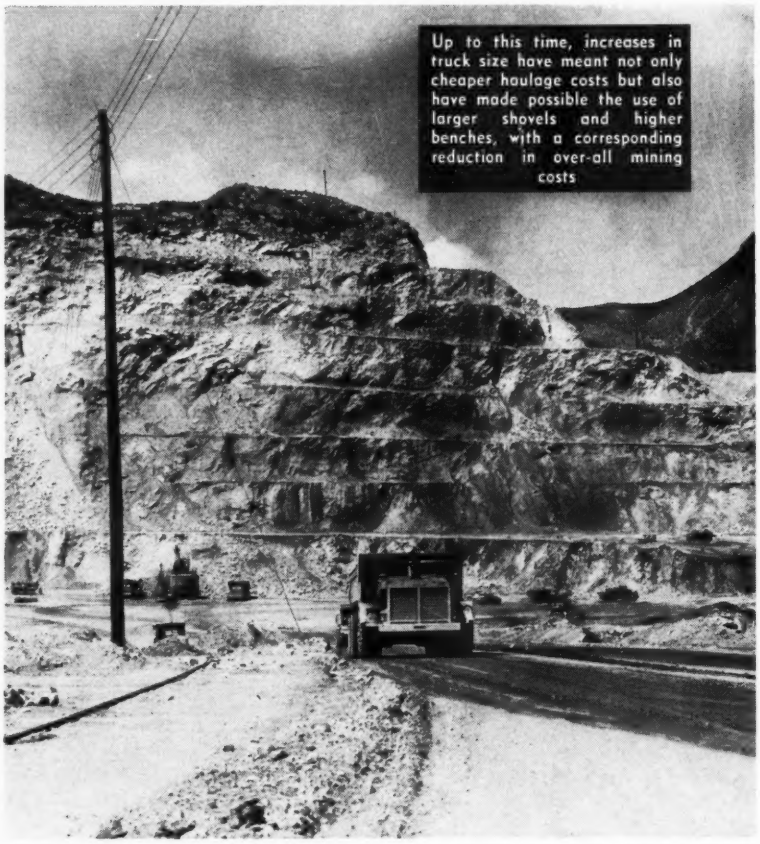
Truck haulage improvements are anything that lowers costs and down time. And although it becomes diffi-

(*Continued on page 41*)

(*Continued from page 38*)

Castle Dome's production the approximate tonnage being moved daily was 500,000 tons by rail and 50,000 tons by truck, or about 10 percent of the total.

Today there are four rail pits and eleven truck pits in operation. All of the rail pits now use trucks to supplement rail in certain areas, and the approximate tonnages being moved daily are 470,000 tons by rail and 430,000 tons by truck or nearly 48 percent of the total.



Up to this time, increases in truck size have meant not only cheaper haulage costs but also have made possible the use of larger shovels and higher benches, with a corresponding reduction in over-all mining costs

These figures point to several things. One, that most of the tonnage now being mined by trucks is new tonnage from ore bodies whose size, shape or location made them uneconomical or impossible to mine by rail. The fact that trucks have made possible nearly a 100 percent increase in open pit copper production is certainly a major contribution to the mining industry.

Two, that with the exception of one rail pit in which there was a radical change in mining conditions, trucks in their present stage of development have not replaced rail when moving large tonnages over long distances on up to three percent grades. Considering the facts that some of the rail pits are mining at considerable depths below the pit rim or entry point, and that haul distances for rail, say on a three percent grade to climb out, are three times the distance that would be required for trucks on a nine percent grade—coupled with the growing use of inclined skips and the expected improvements in trucks both as to size, horsepower, and operating cost—it is safe to predict that tonnage moved by trucks will continue to increase and that a good portion of this increase will be at the expense of rail.

Great Improvement in Design Noted

Since the author's introduction to haulage trucks at Castle Dome in 1943, steady gains have been made in increasing truck productivity by increasing capacities, horsepower and ease of operation. The haulage unit then in use at Castle Dome was known as a Knuckey and was assembled in San Francisco. It carried 30 tons, had chain drives, a 150-hp engine, manual steering and mechanical clutch and gear box, and had a top speed on an eight percent grade of about 3.0 miles per hr. In rainy weather there were drive chains scattered from one end of the pit to the other. The cab consisted of a seat with a windshield in front of it and it took several months to break in a driver. The latter was due to a five-speed gear box with an over and under drive so that, in gearing up, shifting of the gear stick and the over and under stick had to be done simultaneously. This was quite an art and Castle Dome had few artists so the truck repair shop was a busy place.

This is not intended to belittle the Knuckey truck as it did an excellent job in its day. But if there had been no improvements in trucks since then, a great number of the truck pits now operating would still be uneconomic ore bodies.

Nominally a thirty-ton truck now has a 300-hp engine, 34-ton has 400 hp, 50-ton 650 hp, and power trains, axles and frames have been built to take these increased torques. Tires have changed from cotton fabric to rayon, and then to nylon, to take the increased loads and heat. Torque converters and automatic transmissions have replaced the old clutches and gear boxes. These features, plus power steering, have made heavy trucks almost as easy to drive as an automobile. A driver can now be trained within a few weeks, as all he has to learn is the feel of the weight behind him, the clearances of his truck, the pit driving pattern, and the rules on truck care and safety.

Costs per ton-mile are close to one-half of those on the old Knuckeys and each new advance continues to lower that figure. For example, at Ray the ton-mile costs on comparable hauls is presently about 17 percent less on 50-ton trucks as compared to 34-ton trucks. Since the 50-ton trucks are much newer and therefore require less maintenance, this figure probably will ultimately be in the neighborhood of 12 percent. In some operations using 22 and 34-ton units, this same figure of 12 percent is the approximate saving they have found in the larger trucks. These cost improvements are due directly to greater productivity, principally through larger capacities and increased horsepower.

In rough figures a comparison of the 50-ton trucks to the 34-ton trucks

in the principal items at present is as follows:

	34-Ton	50-Ton
Average load (tons)	36.14	54.15
Capacity	100.00%	150.00%
Ton-miles per shift	100.00%	134.00%
Operating labor per operating hour	100.00%	100.00%
Fuel per operating hour	100.00%	123.00%
Lubricants per operating hour	100.00%	109.00%
Tires per operating hour	100.00%	157.00%
Maintenance labor per operating hour	100.00%	89.00%
Maintenance parts per operating hour	100.00%	104.00%
Total per operating hour	100.00%	110.00%
Ton-mile cost	100.00%	83.00%

Note that the figure on tires of 157 percent is the only one that is greater than the productivity of 134 percent. The tire manufacturers are constantly improving tire construction, and in time this cost probably will show a worthwhile decrease.

Bigger Units in the Future

Up to this point bigness has meant not only cheaper haulage costs but has also made possible the use of larger shovels, higher benches, etc., with a corresponding reduction in overall mining costs.

We haven't reached the ultimate in size yet, but there is a limiting factor and that is maneuverability. Where the balance point lies between the two remains to be seen.

The manufacturers are to be complimented on the improvements that have been made and their demonstrated willingness to pioneer new developments. The operators, too, have an obligation to share in this development by field testing and working with the manufacturer to continue these improvements.

In the meantime, while we're waiting for engines and drive train components to be built so that capacities and horsepower may be still further increased, the manufacturers can continue to give serious study to improving what we now have, by building to reduce maintenance requirements on our present trucks.

In summation, the operators are searching for cheaper costs per ton-mile and they don't care by which route they get it, cheaper maintenance or greater productivity, but they are expecting both.

AT THE OPERATION

(*Continued from page 39*)

cult to calculate worth, maintenance can definitely play a major role in truck improvement. Let's look at a few general examples.

The demand for engines with more horsepower and the innovation of torque converters and retarders in the power train resulted in the need for a cooling system with increased capacity. The result, of course, was the incorporation of larger and larger radiator cores. And as the core size increased, its life decreased to about 1500 to 2000 hr. Investigation showed that fatigue failure of the header sheet along the outside row of tubes, or a failure of the tubes themselves, was responsible for the low rate of performance.

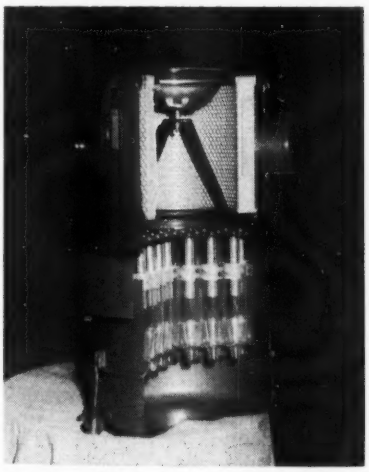


Fig. 2. This air cleaner has performed beyond highest expectations. The small plastic cyclones in the bottom portion remove a high percentage of the entrained dust. Air flow then reverses direction and passes through top half—a pleated paper element

For many years, experiments and field tests including such things as changing radiator mountings, varying the thickness of header sheets and tubes and other design changes were conducted. The changes were helpful but not wholly successful. Following field tests, laboratory equipment was developed to simulate the natural frequency and shock input to a core under actual operating conditions. And here's an interesting sidelight. Information compiled for the design of the laboratory machine showed that maximum shock came from the body bouncing on the frame rail and not from the front axle dropping into a chuck hole or hitting a bump at high speed.

In an effort to eliminate these radiator problems, a dished or concave header sheet design such as shown in figure 1 (left) is being tested. Ten test cores were put into service and fifteen more added later. The first cores have been in operation more than 7000 hr without a failure.

Another core design, see figure 1 (right), being tried was developed in England. This core consists of individual finned tubes connected to a header sheet by synthetic rubber ferrules. A series of cooling capacity experiments were first conducted, proving the cooling capacity satisfactory. The M. A. Hanna Co. is presently testing ten of these and some have been in operation more than 4000 hr without a failure. This design has two big advantages. First, it's easily repaired in the event of a failure and secondly, it is readily adaptable to most equipment.

Both cores were run on the laboratory test machine and had over 2000 hr without failure. Many conventional cores failed in 100 to 1000 hr. These results indicate that radiator problems have been solved, eliminating a high percentage of engine overheating and cylinder head crackage.

Better Air Cleaner Developed

Higher horsepower also brought with it larger investment and requirements for longer engine life. One of the bigger reducers of engine life is dust. This and other factors clearly indicated that an improved air cleaner was desirable.

As with most mechanical developments, the improved cleaner came through a step by step process. Industrial type dry filters were tried without complete success. Dry type primary cleaners of automotive design also proved inadequate. Oil carry-over, resulting in short element life, eliminated the use of an oil bath primary with a dry type after cleaner.

For the past year, tests have been

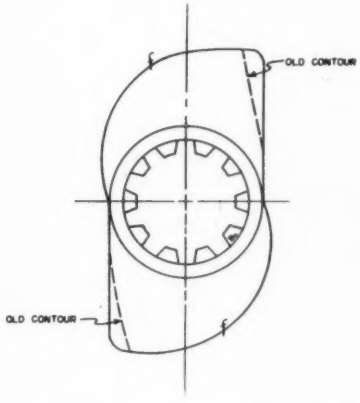


Fig. 3. By extending the cam nose, and, hence, the cam throw, enough to compensate for average drum wear conditions an appreciable amount of brake life is gained

run on four dry type air cleaners which have functioned beyond highest expectations. They consist of a lower section of small plastic cyclones which centrifuge out a high percentage of the entrained dust. (See figure 2.) The air flow then reverses direction and passes through the top half of the cleaner, containing a pleated paper element. The cleaner is quoted at 99.6 percent efficiency regardless of cubic feet per minute. The cyclones are of such size that lower cfm's do not spoil their efficiency.

It has been further determined that oversizing the cleaner pays dividends in hours between servicing. During the summer months when the most adverse dust conditions are experienced, a 14-in. cleaner required servicing every 250 to 350 hr while a 16-in. cleaner ran over 800 hr. During winter operations the 16-inch cleaner ran more than 1500 hr before maximum restriction was reached. There was a little evidence of the cyclones building up with dust around the lower opening but the amount was small and cleaning presented no problem.

Radiator and air cleaner improvements have resulted in holding the line on costs, helping to make the higher horsepower, more expensive engines practical.

Properly Spaced Oil Changes Important

There is little doubt that changing engine oil at the proper time will contribute to efficient truck operation which can definitely be termed a truck haulage improvement. Lab analysis of oil samples has proved that each engine is different and must be treated as such for best results. This information also clearly indicated that an oil change program based on a certain number of hours operation could be improved.

Preliminary lab work showed that the blotter spot method to control engine oil change periods was made-to-order. Throughout Hanna's operations on the Mesabi Range in Minnesota the blotter method has been in use since 1953. The results have been excellent — the time between oil changes has been tripled. The spot method also gives us a running account of the needs of the individual engine.

In making blotter spot tests, number one grade lab filter paper is used. One drop of oil from the dip stick of a warm engine shows the degree of contamination through various shades of gray to black; the presence of water by lack of spread and a dark border; proper dispersant action by a gradual fading, spreading and lacy appearance.

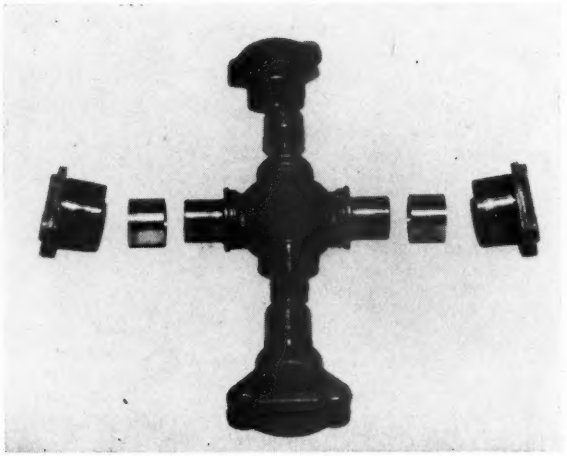


Fig. 4. Hanna has been experimenting with bronze bushings in place of needle bearings on the universal joint. The company has found that the biggest advantage of a bushed joint is that on failure it does not throw the drive line

There are other advantages to the blotter tests, too. A trend of oil spots from the same engine can provide valuable information on mechanical conditions. Any sudden change in the pattern will indicate potential trouble. The trend of oil spots also enables a simple system for field testing lube oil filters. Proper safeguards against the occurrence of corrosion or dilution are required with this program.

For the next few paragraphs, the writer would like to discuss service brakes. With the advent of torque converters and the increasing size of haulage units, the life of service brakes has been shortened and, of course, costs have risen. Retarders have been a big help, particularly now that they are available in a common package with the converter and transmission, thus eliminating most of the plumbing complications. There are cases, however, when a job does not warrant the additional expense of retarders and a longer life on the service brake system is required.

Some of the manufacturers have discarded the old cam and shoe principle and are trying other designs. One is trying a disc type of brake. A recent entry, also patterned after aircraft design, is of the internal expanding tube type with segmented shoes spaced evenly around the entire circumference of the drum. It is an air over hydraulic system and is self-adjusting for wear. If successful, it is hoped that they will be adaptable to existing units.

What is the solution for better brake life on present trucks? Good maintenance practice helps. Proper turning of drums and linkage adjustments add life. Because brake cams are usually designed for zero drum wear, the cams turn over center with a reasonable amount of lining left. By extending the cam nose and, hence, the cam throw, enough to compensate for average drum wear conditions, an appreciable amount of brake life is gained. (See figure 3.)

Another item which should help brake life is a special cast drum now being tested. This drum is beefed up and weighs some 20 percent more than the O.E.M. drum. It is meehanite casting having high tensile and hardness factors. It is too early to predict the end results but after 1200 hr it looks favorable.

The last part of this discussion deals with drive lines. A problem on tandem axle trucks is excessive wear on the needle bearings of the universal joint which causes them to bind and split the bearing cap, allowing the drive line to swing free resulting in damage to other components.

About two years ago, Hanna began experimenting with the use of bronze bushings in place of needle bearings. (See figure 4.) Although the company experienced some early failures, some bushed U joints have run over 6000 hr. The average of all of our test work looks good enough to consider installation of bushed joints in a complete mine fleet.

Hanna has found that the biggest advantage of a bushed joint is that on failure it does not throw the drive line, and a secondary advantage is low cost salvage by grinding the cross and inserting oversize bushings.

The things mentioned above are just a few of the general contributions to truck haulage improvements. There are others. For example, high profile tires, plumbing simplifications and better steels for gears and structural members. These advancements could make it possible to economically retain old equipment.

ROOF CONTROL in THIN SEAMS

Using an extra long bolt in conjunction with a conventional bolting plan, Island Creek Coal Co. has developed a system of roof support for a thin seam operation that is successfully holding bad top in rooms up to 55 ft wide

STONIE BARKER, JR.
Mine Superintendent
Island Creek Coal Co.

Because of the rapid depletion of coal seams having favorable physical conditions and a top requiring very little support, operators are being forced to mine the thinner seams with more adverse roof conditions. Until the advent of roof bolting a few years ago, thin seams having poor roof conditions were difficult to mine for several reasons. A system of timbering employing posts and cap pieces along each rib did not provide adequate support and frequent roof falls were encountered. Crossbars thick enough to support the roof reduced the vertical clearance so that equipment could not travel, and the thin seams with bad top conditions that were mined usually employed some system of conveyors whereby a very close method of timbering could be utilized. Many of these seams were mined by hand-loading on conveyors, using shortwall machines to undercut the faces. However, due to the ever-increasing labor and supply costs, companies are having to turn to other systems of mining and roof support plans in an effort to increase their production rates. Even today, many of the thin seams with adverse roof conditions are mined using some modification of the conveyor system with very close conventional timbering.

This article will describe a mine which at present is using mobile loading machines, bridge conveyors and chain conveyor lines. Roof bolts and steel safety jacks are employed in the face area for temporary roof support, followed by several rows of posts along each rib for permanent roof support.

In 1950 Island Creek Coal Co. started mining operations in the No. 3 Elkhorn seam, which averages 30 to 34 in. in thickness, at Evanston, Breathitt County, Ky. Access to the seam, lying approximately 300 ft below drainage in this area, is through a 1250-ft slope. Coal produced from the No. 3 Elkhorn in this locality can be used for the following: residential and commercial heating, steam generation, by-products and metallurgical uses. The coal averages less than two percent ash, 0.7 percent sulphur and 13,000 Btu's per lb.

Several Methods of Roof Control Tried

The immediate roof overlying the 30-in seam consists of four to ten ft of laminated layers of slate and shale and streaks of coal up to ¼ in. in thickness. Immediately above this strata is a "rider seam" of coal averaging eight to ten in. in thickness. Studying these roof conditions, the company realized that adequate roof control and support would be a major production problem.

Mining operations were started using shuttle cars and mobile loading machines. The system of timbering employed utilized posts and cap pieces which were set alongside the roadway, with additional rows set along each rib. Due to such adverse top conditions, management was forced to abandon this system of roof support.

Sectional drill steel and sectional roof bolts were next tried, but the laminated roof separated at the point of anchor and frequent falls occurred, especially at intersections.

Due to the failure of the system of roof bolting and posts for roof support, management was forced to try a system of timbering using crossbars and posts. It was learned that installation of crossbars thick enough to support the roof over the spans required for the roadways reduced the vertical clearance to a point which prohibited equipment to travel. Three-in. headers were then tried, but the roof over the roadways continued to sag outby the faces to such an extent that, again, the equipment did not have proper clearance to travel.

The system of mining and roof support was replaced with shaker conveyors dumping on chain conveyors. They, in turn, dumped onto 30-in. belt conveyors which discharged into mine cars. Two crossbars, three in. in thickness and 16-ft long, set on steel safety jacks, were installed as each cut of coal was loaded out. As the swivel point of the shaker advanced, the steel jacks were replaced with four wood posts with two addi-

tional rows set along each rib. This method reduced the span over the roadway to six ft which reduced roof falls. The result was higher production rates than any system previously used.

Roof Bolts and Safety Jacks Provide Adequate Support

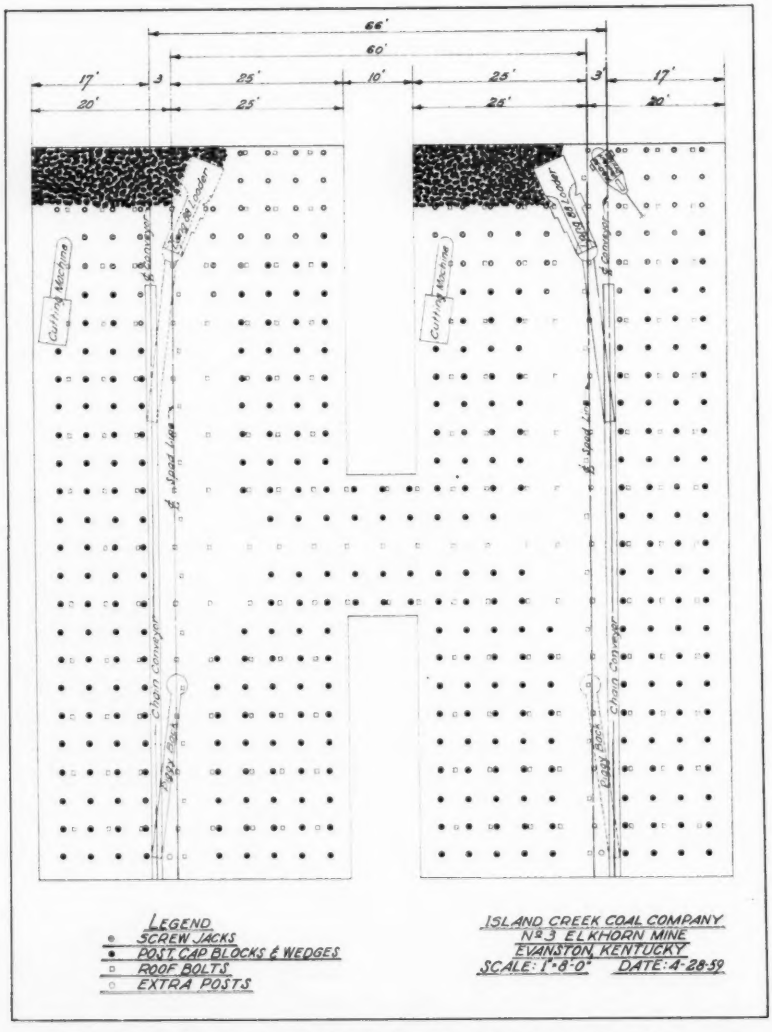
This system was employed until early in 1954 when it became necessary, due to higher wages and mining costs, to increase production rates. After very careful study, it was decided to try the system which is presently being used—a mobile loading machine loading into a bridge conveyor which dumps onto chain lines. Roof bolts, in conjunction with steel safety jacks, are utilized in the face areas for temporary roof support, followed by posts and half headers for permanent support. This method of roof support has the advantage of maximum vertical clearance and permits maximum maneuverability of equipment in face areas.

After experimenting with this system, production rates were improved to such an extent that it was decided to replace the shaker units with seven sections of equipment, each section consisting of: one mobile loading machine, two shortwall cutting machines, one rotary roof bolting machine, chain conveyors and hand-held coal drills.

For each cut of coal removed, one row of 30 in. bolts, five feet apart, is installed. One man with rotary drill roof bolts immediately behind the loading machine as it moves across the face loading out the coal. This has the advantage of bolting and timbering the faces before the roof has time to sag or settle. Also, the face is entirely bolted by the time the machine crew arrives to begin cutting operations, resulting in no delays to them and others on the preparation crew.

Rows of bolts are approximately eight ft apart (one row per cut) with one 60-in. bolt being installed between the rows in the center of the 12-ft roadway. Holes for this 60-in. bolt are drilled with 15 and 30-in. extension drill stems. The bolt is installed in the following manner. The operator bends the bolt in the center so that the ends are perpendicular to each other, the end with the chuck is inserted in the hole as far as possible, the remaining half is straightened and pushed all the way into the hole. It is then tightened with an impact wrench to desired torque. Time taken for this procedure, (bending, inserting in hole, straightening out and tightening) will run from 60 to 90 seconds.

A minimum of 15 steel safety jacks is kept set in the face of the rooms and ten in the entry faces. More are used if necessary. These safety jacks, in conjunction with the roof bolts, provide adequate temporary support in face areas during the preparation and loading cycles. The jacks are removed and reset as the faces advance.



Timbering standard for use with Piggybacks and 88 Pigloaders in 45-ft wide rooms

60-In. Bolt—Key to Success

In the beginning, a 60-in. test hole was drilled for each cut of coal loaded out to determine the nature of the roof—whether or not it had sagged, cracked, etc. If any unusual condition was noted, a 60-in. bolt was inserted. This proved so successful in preventing falls in the face areas that it was decided to place one 60-in. bolt for each cut of coal removed. Probably the key to the success of this timbering system is the 60-in. bolt installed for each cut prepared.

Permanent timbers are set to within 1½ cuts of the face. These consist of wood posts and cap pieces set on four-ft centers within two ft of the ribs. A 12-ft wide roadway is left in approximately the middle of the place. As the faces advance and additional breakthroughs are made, and the bridge conveyor is moved to a point just outby the last breakthrough, an additional row of center timbers is set along the pan line and the old breakthrough center timbered. In all, approximately 20 posts are set per cut in rooms and 14 per cut in

entry work. This system of timbering is used over the entire mine in rooms, panel entries and main development entries.

Very little cribbing is done. They are used only in places of excessive weight to reinforce the standard timbering to permit removal of equipment in case "rides" or "creeps" are encountered. To date, a few "rides" have occurred. However, by close observation and a slight change in mining projections, the coal is recovered and the "rides" do not present too great a problem.

Mainline Haulage Entries Are Brushed or Graded

Eight main entries are driven 28-ft wide on 60-ft centers, with breakthroughs on 80-ft centers, except between pairs or sets of entries where breakthroughs are on 180-ft centers to reduce ventilation costs. Mainline haulage entries are brushed or graded so that 5½ ft of clearance is maintained over the rail. Six-ft, wedge-type bolts are installed in these entries on four-ft centers. A row of 10 by 10-in. treated posts and cap pieces are set between the tracks (because double track haulage is used) and a row of 7 by 7-in. treated posts and cap pieces are set along each rib.

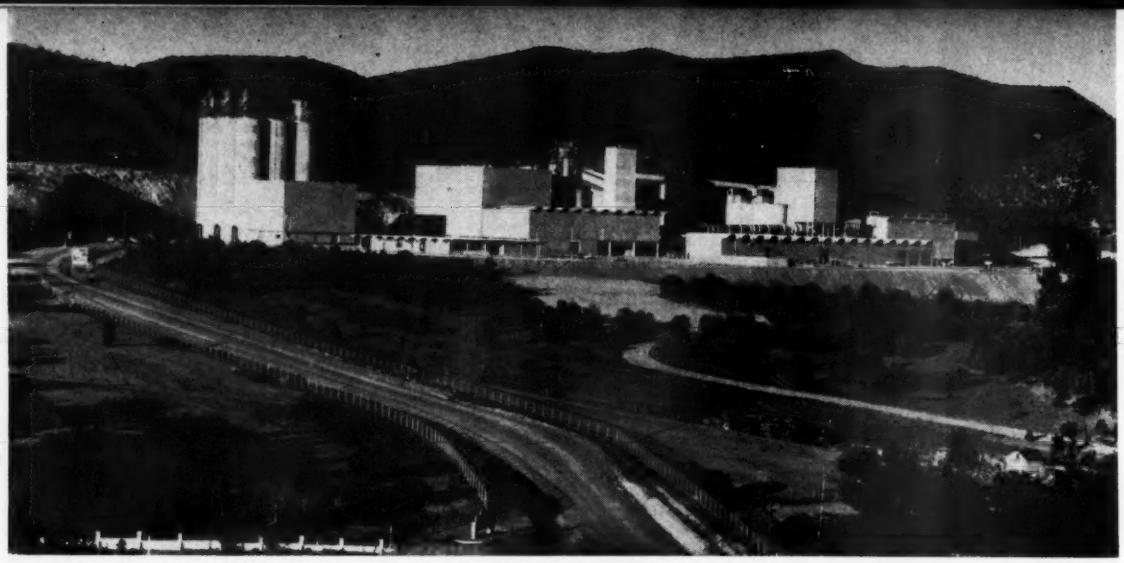
Butt or panel entries are turned off either side of main entries in sets of four every 760 ft. These are driven on 55-ft centers, 30-ft wide to a depth of 2600 ft. Breakthroughs are driven on 60-ft centers so that rooms will be on 60-ft centers in pulling back the panel. Rooms are driven up to 55-ft wide, with the average width being 45 ft. All rooms are driven to a depth of 380 ft in solid coal. Room chain conveyor lines on one side of belt are 435-ft long when the rooms are finished, and 490-ft long on the other side.

In developing the room or panel entries, five roof bolts are set along the rib in No. 1 and No. 4 entry where rooms will be turned off in pulling the panel back. The bolt on the center line of each of these rooms is 60-in. long, and two 30-in. bolts are installed on either side of it. Installation of these bolts prevents many falls and requires a minimum of dead work in taking the first cuts out of the rooms on retreat.

75 to 80 Percent of All Bolts Are Recovered

No attempt is made to recover any posts when mining operations are finished in the rooms; however, from 75 to 80 percent of all roof bolts and plates installed are recovered, including the 60-in. bolts. Because timbers are set on four-ft centers except in the eight-ft roadway, a minimum amount of safety posts are required in recovering the bolts. These are recovered immediately following completion of mining operations in a pair of rooms and after the section has moved back to a new set of rooms. Recovered bolts are reused several times in the rooms and finally are installed permanently in main development entries.

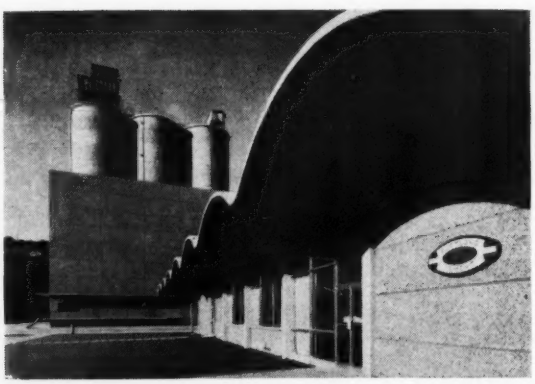
This system of roof support has been developed over a period of years. Since changing to mobile loaders and bridge conveyors in 1954 and 1955, production rates have risen steadily until, at present, some sectional units are producing in excess of 35 tons of material per man.



The new $14,000,000 Tijeras, N. M., cement plant of Ideal Cement Co. presents a surprising sight to visitors and residents of the area. When the plant is in full operation, there is no visible dust loss—thanks to an extensive and highly effective dust filtering system

the Ideal Look

No stack and no dust! A new ultra-modern cement plant at Tijeras, N. M., features the latest in dust collecting systems, instrumentation and architectural concrete design



One of the most impressive features of the plant is its modern appearance—created by the imaginative use of the company's product. Shown is the plant office building which reveals the use of mosaic-type precast concrete wall panels and an unusual precast concrete roof

IDEAL Cement Co., one of the nation's leading portland cement producers, recently dedicated its 16th major U. S. cement plant at Tijeras, N. M.

The plant, an ultra-modern $14,000,000 facility 16 miles east of Albuquerque, is the first cement plant ever to be located in New Mexico, and is an integral part of Ideal's ten-year, $176,000,000 expansion and modernization program which was announced in 1955. The program is designed to increase the company's capacity from its 1955 figure of 22,000,000 bbl to 40,000,000 bbl by 1966. Completion of the Tijeras plant brings the company's annual capacity to 34,000,000 bbl.

The extensive use of concrete throughout the plant is one of the most impressive things about the new

facility. Curving concrete roofs, long (up to 75 ft) prestressed, precast concrete beams and columns, concrete paving, and precast mosaic wall panels are everywhere. Even the light poles and fence posts are of concrete.

Another unique feature of the plant is that it has no stack. All gases from the kiln are filtered through a system of 1280 glass cloth bags. These glass bags are 11½ in. in diam by 25 ft in length. More than two acres of glass cloth are used in this system.

Plant Operation

Ideal's New Mexico plant is one of the most highly instrumented cement plants in the world today. The entire production process, from the quarry to the final storage, is controlled from a single centralized control room. With electronic recording and control instruments at his finger tips, the control room operator is in full command of all production equipment.

At Tijeras, limestone is obtained from the quarry nearby and trucked to the plant where it is reduced to minus 3/4-in. by a primary impact breaker and a secondary impactor. The crushed rock is drawn from a series of four raw material silos, containing three different grades of rock, with sampling at regular intervals to assure the proper composition. It is then ground to 85 percent minus 200 mesh in an 11½ by 17-ft ball mill. The pulverized raw mix is next transported by a Fuller Kinyon pump to one of four 4000-bbl blending silos, where it is "homogenized" by blowing air through it.

From the blending silos the kiln feed is transported to the 375-ft kiln which slopes 3/8-in. per ft. Near the firing end of the kiln the temperature reaches 2750°F, and the mix is fused to marble-sized particles of clinker.

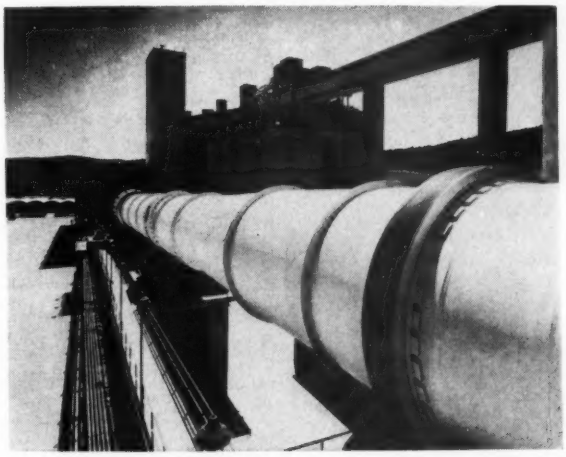
Dust-laden gases from the kiln are filtered through an elaborate system composed of 1280 woven glass cloth bags. The 11½-in. by 25-ft bags are collapsed periodically, and their contents recycled to the kiln by a dust screw conveyor. The highly efficient filtering system results in no visible dust loss, consequently reducing air pollution to a minimum and saving large quantities of cement which would ordinarily be lost on the countryside. (Gordon W. Barr, production engineer of Southwestern Portland Cement Co. gave a detailed description of a similar system at the 1958 AMC Mining Show.)

After the clinker is cooled to about 100°F in a 6 by 85-ft Allis-Chalmers cooler, it is conveyed to one of four 9650-bbl storage silos which also serve as clinker mill bins.

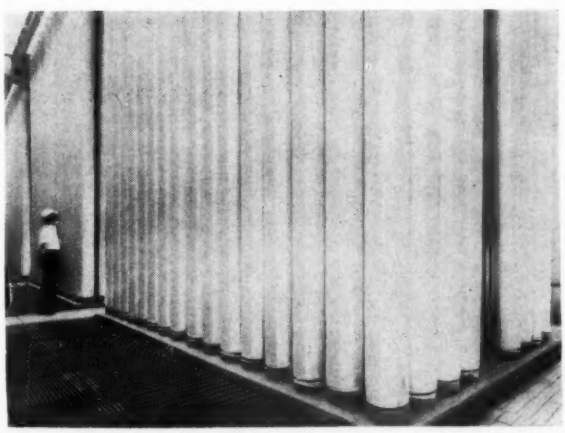
For the finish grind, the clinker is fed into another 11½ by 17-ft ball mill. This mill is closed circuited with an air separator which returns oversize to the mill. The finished portland cement is ground to 90 percent minus 325 mesh and is pumped into a series of nine 15,000-bbl storage silos or four 8500-bbl interstice bins. Silos are 131 ft high and 30 ft in diam, with a cumulative capacity of 169,000-bbl, or 31,772 tons. The silos are elevated so that cement transport trucks may be driven under the silo hoppers and loaded by gravity. Truck scales 140 ft long are installed under each bank of three silos, permitting trucks to be loaded under any one of the silos and still remain on the truck scale.

The pack house has three packing machines capable of packaging a total of 3600 sacks of cement per hour, or one 94-lb bag each second.

Representing the epitome of automation in raw materials processing, the control room includes TV monitors on which clinker formation can be viewed. All production equipment can be regulated from this well-lighted, immaculate room



The heart of the Ideal plant is the kiln. It is 375 ft long and 11 ft in diam, except for the first 50 ft at the upper end which is 12 ft in diam. The kiln is entirely lined with refractories and weighs a total of 2,173,661 lb



Keenly aware of the increasing interest in the problem of air pollution, Ideal has installed a comprehensive array of equipment to make the Tijeras plant a clean and dust-free operation. There is a total of 33 different dust collection systems at strategic locations throughout the plant. The most interesting and unique of these is the elaborate system which completely filters the exhaust gases from the kiln. This collector is actually a gigantic vacuum cleaner composed of 1280 woven glass cloth bags (above), each 11½ in. by 25 ft. Dust-laden exhaust air from the kiln is forced into the bags which are collapsed periodically, their contents emptied into hoppers and carried away by a dust screw conveyor and returned to the kiln. The over-all cycle takes about 60 minutes

Selection of Supervisors

Good supervision is the primary defense of any coal producer in the constant battle against rising costs. The author suggests: Scholarships to encourage interested students to take mining engineering . . . Development of a useable tool to help mine management in the selection of supervisors . . . Adjusting the curriculum of high schools serving coal mining communities to permit more specialized training of the students who will look to the mines for employment after graduation . . . A closer look at on-the-job training and other programs as a means of overcoming the scarcity of trained men

By HARRY M. TIBBS
Administrative Assistant
Truax-Traer Coal Co.

THE selection of supervision in underground coal mining is one of major concern and importance. The problem is prevalent throughout the industry and a continuing one.

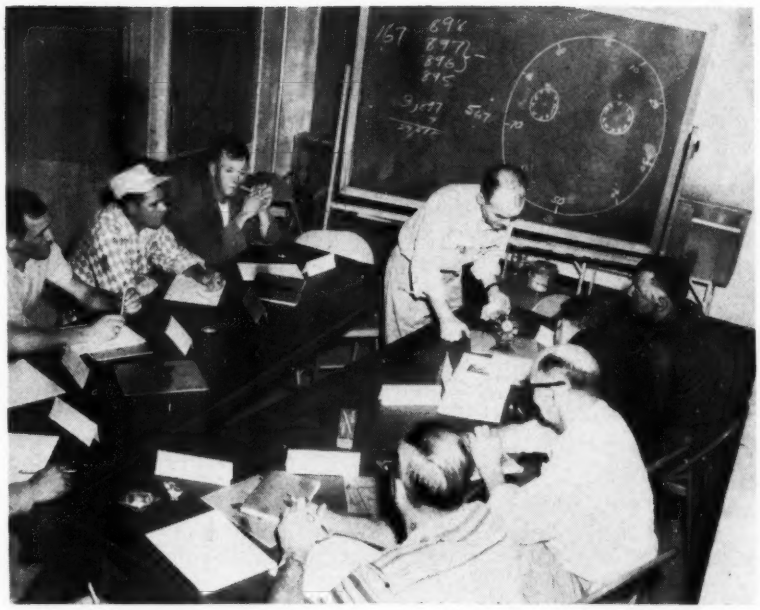
To even leave a minute suggestion that the writer has a panacean approach to this problem of daily concern would be an exaggeration. However, a full-faced analysis of Truax-Traer Coal Company's problem and a discussion of methods that have been used to solve some of the various and several components may prove helpful to others in the industry.

Underground coal mining does not have as great attraction as a livelihood as that enjoyed by even the other so-called hot, heavy and dirty industries. Specifically, even hard-rock mining has a certain glamour in spite of the fact that the employment is quite similar. Perhaps the intrigue of precious metals and the general geographic location of metal mining makes the difference.

Further on the negative side, the writer recalls the story of the great race horse and his relegation to the coal mines and the ignominious ending in blindness. This story made a lasting impression on the writer and helped to form his early opinion of the coal mines. Then, as he became older, he learned in his school sociology class or through the "current events" school paper about the plight of the Welsh coal miners, even to the extent that women and mothers were forced by economic circumstances to pull coal like a horse deep in the bowels of the earth. Later, and with more realism, he read stories and press reports, some slanted more than others, about such events as the Ludlow Massacre, the Logan March and the disastrous explosions of Eccles and Orient mines. The public was repeatedly informed through printed word, and they received with great dramatic portrayal the plight of the coal miner and his family in silent pictures, the talkies and now, of course, via television.

We have all been indoctrinated to a degree with the conditions reportedly resulting from paternalism, company stores, the check-off, the "squalor" of company housing and the strikes with great family suffering.

To the coal miner and his family these drastic conditions always seemed to happen some place else. Besides, even though he may recognize some of the things they were depicting, he knew the stories were exaggerated because he lived and worked in and around the mines and they weren't that bad. However, this wasn't true of the outsider. His impression was formed without being able to rationalize the stories by first-hand information. In addition, he too wanted to engage in the age-old game of championing the down-trodden. Even today there are generally well-informed people who would look askance at anyone who said he lived in a coal mining community and had a modern house including all the ap-



A Truax-Traer foremanship training class in session. New entrants in the mine supervisory family are a must and great gains can be obtained through hiring professionally trained mining engineers to be further trained as production foremen and superintendents

pointments anyone would have in a mid-income family home in a city of 70,000.

Things Have Changed

It's a fact that the coal mining industry has had a lot of bad publicity, but even if it were all true in the past, things are not the same now. The industry has grown considerably with the changing times. Unfortunately, however, there is much work ahead to change concepts formed over many years of concerted effort—years punctuated by the disasters and violent deaths that are associated with any hazardous industry.

The things discussed, together with natural conditions of mining, have drastically narrowed the field of new entrants into the coal mining industry. For all practical purposes, it must depend upon individuals in the mines or those closely associated with the mines or mining communities for their supervision. In short, companies must work with what they have and the men they are able to recruit in their respective immediate vicinities.

Supervisors must be chosen and trained from the ranks or from elevations of current supervisors, unless the industry steps out into the field of the professionally trained such as graduate engineers.

The actual process of selecting supervisors varies as widely as mining conditions, although there certainly is no relationship. It is not uncommon for the selection process to vary within the mine even to the extent of each immediate supervisor. Needless to say, such wide disparity is not conducive to the molding of an efficient organization, especially since the prime factor of selection may be totally insignificant in the prospect's ability as a foreman. Too often a foreman's meeting is not unlike a family gathering.

New entrants in the mine supervisory family are a must and great gains can be obtained through hiring professionally trained mining engineers to be further trained as production foremen and superintendents. However, this is not as simple as it sounds. In the first place, there are not too many coal mining engineers graduating each year. For example, West Virginia University usually graduates less than 15 with coal mining options. In the second place, the few who are available have a choice of many jobs and in many industries other than coal. Naturally, when bidding such as this prevails, the starting salary level sails beyond the reach of the average coal company.

Need to Attract Talent

To overcome this scarcity, the coal industry must provide scholarships and other encouragement which will materially increase the number of students desiring mining as a profession. The local high school principals, together with the university officials, can determine those who have the desire and the scholastic ability; then, with company officials, a determination can be made as to whether or not the prospects are closely associated and well enough acquainted with the industry that they would be likely to take to mining upon graduation. The ideal situation, of course, would be to have the prospective student work in the mines before his freshman year begins. The reason for this is that some students, who have been successful scholastically, simply do not like underground employment. To say the least, it would be a grave error to continue subsidy under these circumstances.

Recently a scholarship student, who

A trainee receives on-the-job practice and instruction. The selection of new supervisors and the elevation of current ones must be carefully done by the head and not the heart

wanted to know more about Truax-Traer's summer employment program, visited the company between semesters. After management explained its plan to get students underground as soon as possible, he revealed that summer work with the company was questionable because his folks, as he put it, did not want him to work underground. Without hesitation, management had to tell him it could not continue his scholarship because he was not enthusiastic about working underground.

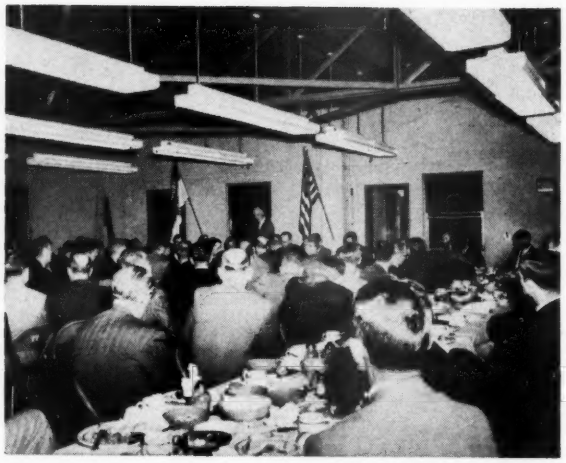
It is understandable that some young people are frustrated to the point that they are grabbing at anything which offers an opportunity for a college education. On the other hand, it is suspected that some are just downright dishonest, knowing that they can get two years of basic engineering on a scholarship before the fateful day arrives when they must declare themselves as a mining option.

Then there are always the academic mortalities which occur. However, scholarship money need not be considered a poor investment in the case of a drop-out if the company is able to get him into the mines. First, he's an above average new entrant as a laborer and second, some engineering training is better than none.

Truax-Traer's two scholarship programs differ in that at one school it has eight awards annually—two for freshmen, two for sophomores, two for juniors and two for seniors—while at another school the company has provisions for four scholarships per year, two for juniors and two for seniors, each stipend being twice the amount given in the other program. It goes without saying that at one school there is less academic mortality, yet the other program allows a greater number of mining entrants and the further possibility of the company obtaining partially trained men who couldn't stick out the four years for various reasons.

Selection Methods Vary

Elevation of current supervisors and selection of new ones in the mining industry are done primarily on the basis of what is known about the individuals who are considered as prospects. Usually the prime factor is their performance on the job and ability to produce. Many other things are sometimes taken into consideration such as background, physical capacity, interest in the job, attitude toward supervisors and men, social traits, family relationships, economic conditions, and even leisure time or extra-curricular activities.



Supervisors hear the latest trends in coal marketing at a training meeting. Continuous training is a necessity on an informal day-to-day basis on the job and should also be coupled with after-hours training in subjects related to the operation

Aptitude or ability to perform can ordinarily be measured with above average safety; however, two things are known: one, each man has an horizon beyond which he should not venture and two, when judging past performance management does not always properly weigh the axiomatic occurrence that good conditions make good supervisors. Also, there is the problem of whose standards are being used. Is it the standard set by an individual or a standard set by the company and are they the same? For example, consider the story of a group sitting around the table at a Workmen's Compensation conference. One of the conferees allowed that the loss of an eye was not worth more than $2,500.00 as a compensation payment. Another earnestly asked the question of whose eye he was talking about.

Taking a closer look at the problem of selecting supervisors, some areas of agreement can probably be safely assumed:

1. There is a field of selection limited to those in the industry and the new entrants from mining schools.

2. The level of top supervision permeates to the lowest supervisory positions and, conversely, the level of supervision in the lower positions dictates the level of top supervision, unless disturbed.

There is no complete or practically valid test battery which will tell specifically the man who would be the best selection as a supervisor or a supervisor to be advanced. The selection of new supervisors and the elevation of current ones must be carefully done by the head and not the heart.

3. Continuous training is a necessity, on an informal day-to-day basis on the job as well as with after-hours training in subjects related to the job of mining, which should include safety and management as well as production.

4. Each company must participate in a mining engineering scholarship program in proportion to its total employment.

Look to the High Schools

Because the industry has a limited field from which to choose new entrants, high schools serving coal mining communities should recognize that all of their students will not be going to college and that many will look to the mines for employment. These schools should adjust their curriculum accordingly, even to the extent of offering post graduate and advance courses in electricity, machine shop and equipment operation. There are too few free or public vocational schools in the United States geared to local industry. Schools of this type can be justified purely and simply on the basis of juvenile problems alone. If a youth doesn't go to college, what is there for a 17 or 18-year old to do in a constructive way until he goes to the Armed Services or until he is absorbed by industry? Further, there are the young men who quit high school before graduation simply because they are not getting training that is directly related to employment not requiring college training. Then, there are the idle gangs of young men around our communities who for the lack of constructive opportunities turn to the only avenue open—it is termed juvenile delinquency. The public owes them a better opportunity and, at the same time, is not getting the full value of its tax dollar.

Selection of supervisory personnel with the head and not the heart is not

a simple operation. Judgment must be freely used, and all factors must be weighed and rated. Although some one individual must eventually make the selection, this oneness must not preclude undictated consultation with others who may be better informed about some phases of the individual or individuals than the person making the final decision. True, production makes the mare go and the man may be a top-notch coal rustler, but keep in mind that a supervisor can only accomplish through others. Does he have or will he obtain prestige from the men he'll be working with? Is he loyal? Will his personal habits and home life be derogatory? Is he safety minded? Does he have the physical and mental capacity to withstand the pressures of the new job? Is he able to accept the new responsibilities and, more important, does he want them? Is he energetic? What is his attitude toward his employer, his work, employees and associates? Is he fair? Is he academically equipped for the prospective job? Can he make decisions? Does he get both sides of the story? Does he have control of his temper? Does he give clear instructions and otherwise communicate well?

Best Man For the Job

To list in this article all the factors that would be important in the process of choosing the best candidate for a particular job is an impossibility. However, with some research on the part of both practical production men and trained personnel men, a useable tool could be devised that would be most helpful to mine management in the selection of supervisors. Such a tool could even include some testing of personality, intelligence, aptitudes, etc.; however, at best, the composite could not be expected to be more than a guide and mistakes would still be made but undoubtedly to a lesser degree. Even with a testing and analysis program, judgement of people on the job would continue to be the most important factor. While it is immaterial as to who would be assigned this research project, it would not be far fetched to say it could be done by one of the present coal research organizations with little supplementation.

In the meantime, supervisors charged with selection can materially help themselves by comparing candidates in much the same fashion as a purchasing agent would compare quotations from several companies for a similar piece of equipment—i.e. the names of the candidates down one side of the sheet and the several factors important to the job across the top of the paper with a block for each behind the candidate's name. The factors must, of course, be weighted with experience and job performance given greater consideration. This approach may sound silly to some but trying it may prove very revealing. In any event, following this procedure may give the supervisor some peace of mind or justification for the decision he had planned to reach anyway.

Learning the finer points of first aid in the field. Training course participants give many clues as to their supervisory ability

Training Programs Are Worthwhile

The possibilities of on-the-job training are numerous, feasible and, to say the least, worthwhile. Trade magazines of the industry have for many years reported successful programs conducted by several companies at different times and with various approaches. To the author's knowledge, there has never been a compilation of these programs. The gathering of this information would certainly set a pattern of what has been done and serve as a guide as to what others could do.

It has been the writer's experience that his company's own technical supervisors, such as safety directors and engineers, do the best job of training in general mining, ventilation, State mine laws and safety, while local schools and universities are best set up to train in special subjects such as electricity, machine shop, mathematics, mechanical drawing, automotive mechanics and diesel engines. Private companies have the better programs covering management, job relations, job instruction, conference leadership, industrial relations and supervisory training. While many private companies are undoubtedly offering training, it is personally known that Training Within Industry and Visions, Inc. (a division of National Foremen's Institute) are offering this type of training for a fee at this time. A directory of courses offered by private companies for a fee would be helpful, especially with a synopsis of each.

On-the-job or after hours training, as it differs from the training given by the immediate supervision while the trainee is working, has immeasurable worth. Participants give many clues as to their supervisory ability. However, if this type of program is to be effectively used as a tool for training new supervisors and elevating old ones, it must be offered on a continuous basis. This requires that a company be large enough to have a full time training supervisor. Trainers soon tire of working two to four nights a week after they have spent a full day on their own job. In view of this, courses must be short and trainers changed frequently. Research directed along these lines should be provided to develop courses which would fit this short-jab pattern—say one night a week and two hours a session for a total of 20 hours.

Scholarships Considered

Truax-Traer has had the opportunity of participating in scholarship

(*Continued on page 62*)

SHAFT SINKING AT HOMESTAKE

Homestake is nearing completion of its extensive development program which has entailed sinking and raising several thousand feet of large shafts over a period of seven years. The program has covered almost every aspect of modern sinking operations—with both rectangular and circular shafts

By WILLIAM C. CAMPBELL
Assistant Mine Superintendent
Homestake Mining Co.

DEEP-level development was suspended at Homestake during World War II and was not resumed until 1952. At that time, the Yates and Ross shafts were down 150 and 60 ft respectively below the 4100-ft level. (See schematic drawing of development program.) A small development shaft, the No. 3 winze, was down from the 4100 to the 5000-ft level.

The development program in 1952 called for deepening the Ross and Yates shafts to the 5000 level, which was the limit of the drum capacities of the hoists, and sinking an internal shaft, the No. 4 winze, from the 4850 level to an undetermined depth. This level was to be the haulage level to the Yates and Ross, and the loading pockets in these shafts would be at the 5000 level.

The haulage drift was started at No. 3 winze and driven to points beneath the Ross and Yates, and in the opposite direction to the location of No. 4 winze. The distance from No. 4 winze to the Yates and Ross is 6700 and 5700 ft respectively.

While the haulage drift was being driven, and from previous experience, it was apparent that rock temperatures about 100° F would be encountered below the 5000 level at near-saturated humidity. Fresh air coming from the Ross and Yates shafts would become too much preheated before reaching No. 4 winze and would be unsatisfactory. It was evident that an air shaft, called No. 5, would have to be driven from the surface to bottom on the 5000 level near the No. 4 winze.

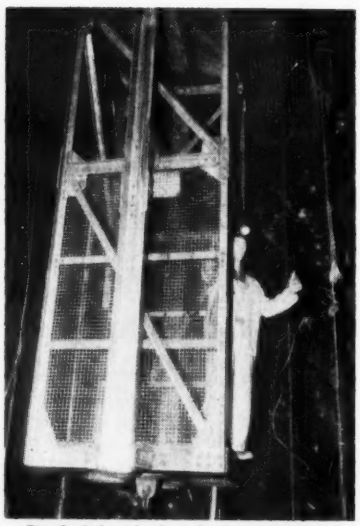


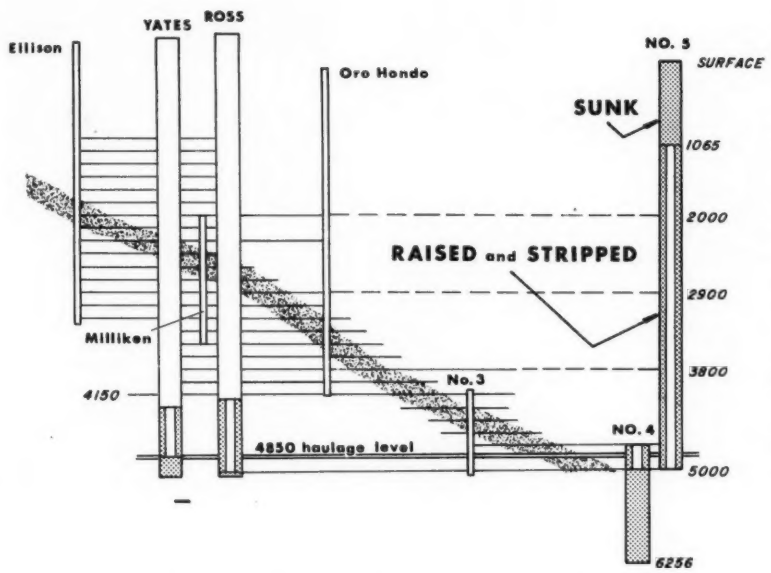
Fig. 1. A four by four-ft aluminum cage was built for lowering men and supplies at the Yates shaft. It had a two-in. pipe through from the bonnet to the deck so that the hoisting rope could go through the cage and fasten to a bucket underneath. The cage served as a crosshead and had a safety catch on the bottom side of the deck which engaged a disc above the bucket. The cage could be set on chairs while the bucket went below the guides. An extension bridle was also built above the cage so that the cage could be lowered below the guides. Note safety screen below timbers

Yates Shaft

The Yates shaft is 15-1/3 by 28 ft outside dimensions of timber. It consists of two cage compartments inside timber, two skips, a service cage, and pipe and manway compartments. The timber is 12-in. Oregon fir. (See table I for statistics on size, rate of advance and costs of all shaft development work described in this article.)

When the 4850 drift level reached the projected bottom of the Yates shaft, a seven by nine-ft pilot raise was driven to the existing bottom of the shaft, over 600 ft above. The shaft was in amphibolite throughout.

The shaft was kept in operation from the 4100 level to the surface while it was being deepened. A sinking hoist was set up on the 4100 level and the service cage compartment (see figure 1) used for stripping the pilot raise. The pilot raise was enlarged to the full size of the shaft, and 12-in. steel bearing beams



Schematic cross section of shaft development work. The Yates, Ross and No. 5 shafts and the No. 4 winze, which are described in this article, are enlarged in horizontal scale for illustrative purposes

		FOOTAGE AND PERFORMANCE				COST (per ft of shaft)				
Shaft	Size	Raised and Stripped (ft)	Rate (ft per man-shift)	Sunk (ft)	Rate (ft per man-shift)	Pilot Raise	Stripping	Sinking	Steel or Timber	TOTAL
YATES	15'-4" × 28'-0"	4850 to 4250 **600**	**0.57**	4850 to 5055 **205**	**0.14**	$29.29	$217.38		$68.32	**$314.99**
								$472.38	68.32	**540.70**
NO. 4 WINZE	12'-0" × 16'-6"	5000 to 4700 **300**	**0.95**	5000 to 6256 **1256**	700 @ **0.25**	13.62	117.65		86.51	**204.16**
					556 @ **0.35**			230.46	86.51	**316.97**
ROSS	14'-0" × 19'-3"	5000 to 4165 **835**	**0.88**	5000 to 5048 **48**	**0.24**	44.39	138.51		95.61	**278.51**
NO. 5	19'-0" diam	5000 to 1065 **3935**	**1.42**	surface to 1065 **970**	—	44.36	102.92*		80.72	**228.00**
								356.00	80.72	**436.72**
TOTAL FEET		5670		2479						

* Includes cost of drifting to pilot raises—$26.24 per foot of stripping

Table I. Footage, performance and cost data. Note the difference in the cost of sinking and stripping. At the No. 5 shaft the cost of drifting for driving the pilot raises should be added to the cost of stripping, as those drifts serve no other purpose. The added cost of the drifts, however, was offset by the fact that stripping could be carried on in several sections of the shaft simultaneously. This increased production from levels where work was previously retarded by the excessive heat and humidity. An interesting comparison is the cost of the Ross shaft steel sets and corrugated lacing now, as compared to 1935 cost. The steel and lacing now cost $95.61 per ft compared to $32.47 in 1935

installed to support the shaft timber. The crew consisted of four shaftmen on each of three shifts who were on contract, a hoistman on each shift, and a timber leadman on one shift.

After drilling and blasting (see figure 2), the rock was slushed from the bottom of the raise into 60-cu ft Granby cars on the 4850-ft level and hoisted at No. 3 winze. The drilling equipment was set up and preparations made to hand timber.

A third shift, usually day shift, hung timber. A timber leadman, not in the contract, supervised the timbering and checked the alignment. The wall plates and end plates are 12 by 12-in., posts and most dividers are 10 by 12-in. Timber sets are on six-ft centers. Originally the 28-ft wall plates were in one piece, but in the new section they were spliced in the center. Fir blocks, wedges, and lacing were used. Steel bearing beams were installed at 200-ft intervals. The cycle was completed in 24 hr and an additional set of timber was gained each week.

The pilot raise was started in October 1953 and the stripping was completed to the 4850-ft level in September 1954. The average advance for stripping was 150 ft per month, the maximum advance in a month was 168 ft. The average advance per man-shift was 0.57 ft.

The bulkhead was then removed below the 4100 level so that the operating cages could work to the 4850 level, and the sinking hoist moved down to that level. A ball-and-chain dump was installed above the 4850 sill so that the buckets dumped directly into Granby cars which were hoisted on the Yates cages.

At the beginning of the sinking operation, a complete shaft round was drilled using a burn cut. The burn holes were drilled with 2½-in. bits, the other holes were 1⅜ in. Between 85 and 90 holes were required to break the round. Drilling equipment (figure 2) was the same as used in stripping. The round was changed after a short time to a bench round due to missed holes occurring.

A Bucyrus-Erie Hydromucker was used for mucking. For a description of this operation see figure 3.

The timbering proceeded as in stripping. A cycle was not completed in 24 hr; however, there was no interruption in the work as one shift started where the other shift left off. The shaft was sunk 205 ft below the 4850 level to make room for loading pockets and storage raises for ore and waste rock. The shaft was finished in May 1955. The average advance for sinking was 0.14 ft per man-shift.

No. 4 Winze

While the stripping and sinking was being done at the Yates shaft, the haulage drift was being driven from No. 3 winze to No. 4 winze. The drift was finished in February 1955. Seven by seven-ft pilot raises were then driven from the 5000 to 4850, and from 4850 to the 4700 level. No cage was required.

The plans were to set a cage hoist on the 4850 level with a rope raise to the sheaves 75 ft above. This hoist is a Nordberg double-drum hoist which has been used previously in another of the company's shafts. It is a 300-hp hoist with a load limit of 17,650 lb, a rope speed of 1200 fpm and a drum

capacity of 1500 ft of 1⅛-in. rope.

In the future, a skip hoist will be set up on the same level with a rope raise to sheaves on the 4700. The skips will dump into ore bins on the 4850 level.

The No. 4 winze uses steel sets which are 12 by 16½-ft overall. The shaft has a cage compartment, two skip compartments, pipe, manway, and counterweight compartments. The sets are on six-ft centers. The shaft is lined with 14-gauge copper bearing, galvanized, corrugated steel.

The sinking hoist which was used at the Yates shaft was moved to No. 4 winze so that stripping and sinking could proceed while the Nordberg hoist was being installed. The stripping from the 4700 to the 5000 level was completed in September 1955. The average advance was 0.95 ft per man-shift.

Sinking was started in October 1955 below the 5000-ft level. The rock was hoisted in 20-cu ft buckets to the 4850 where it was dumped by a ball and chain into Granby cars and hauled to the Yates shaft for hoisting. The rock was hoisted in skips at the surface and transferred to a dump by a conveyor belt. An aluminum cage was used similar to the one at the Yates.

The sinking crew at No. 4 winze was essentially the same crew that was used at the Yates shaft. A four-man crew on three shifts a day were contract. A shaft leadman and a hoistman were furnished.

A bench round was used with the same drilling (figure 2) and mucking equipment (figure 3) as used at the Yates. The round consisted of 35 holes. About four hr were required to drill the round. The rock consisted of Pre-Cambrian schists, quartzite, and slate. A considerable number of rock bolts were used to hold the walls. As a rule, one shift was required to drill and blast, and one shift for mucking which averaged 70 to 80 buckets. Another round was drilled and blasted then the following shift would hang steel and install lacing.

The steel sets were aligned with screw jacks and blocked in place with 12 by 18-in. muslin bags containing a 1:3 cement-sand mortar. The bags are supported by short pieces of one-in. mesh scrap mine screen laid on ½- or ¾-in. reinforcing rods which are bent to hook over the flange of the H-beam. At 75-ft intervals the blocking is covered with a layer of scrap timber to break the fall of any loose rock. It required about 19 man-hr to install the steel

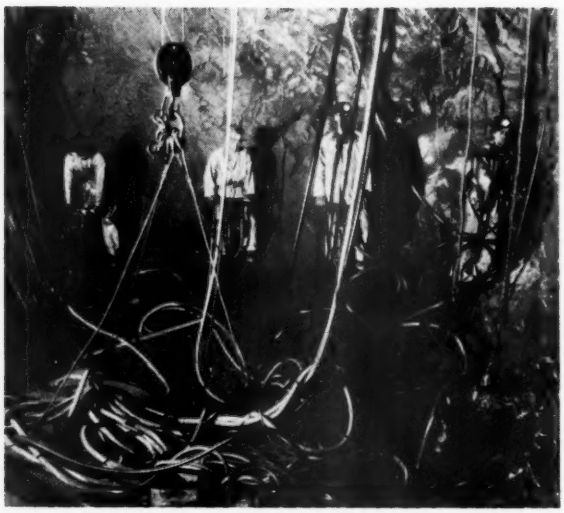


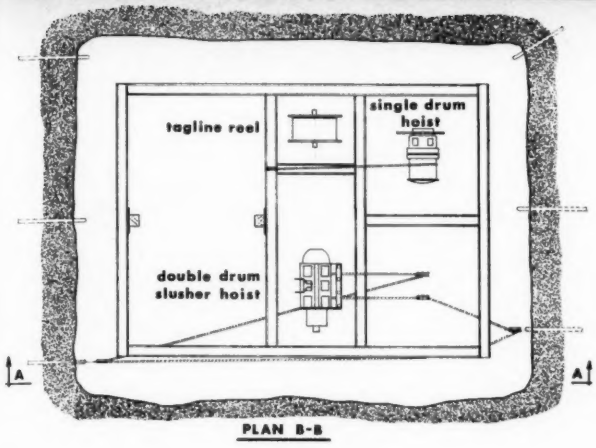
Fig. 2. In stripping and sinking the Yates, Ross and part of the No. 4 winze, drilling was done with Ingersoll-Rand J50 sinkers equipped with 60-lb weights. For stripping the Yates shaft about 60 holes seven-ft deep were required per round. Coromant steel and 1⅜-in. integral bits were used, also some Bethlehem carbon threaded steel with chisel bits. The round was blasted with eight to ten sticks of DuPont Gelex No. 2 per hole. A CD-32 blasting box was used to fire the round

A DOZEN WAYS HOMESTAKE MADE SHAFT SINKING SAFER

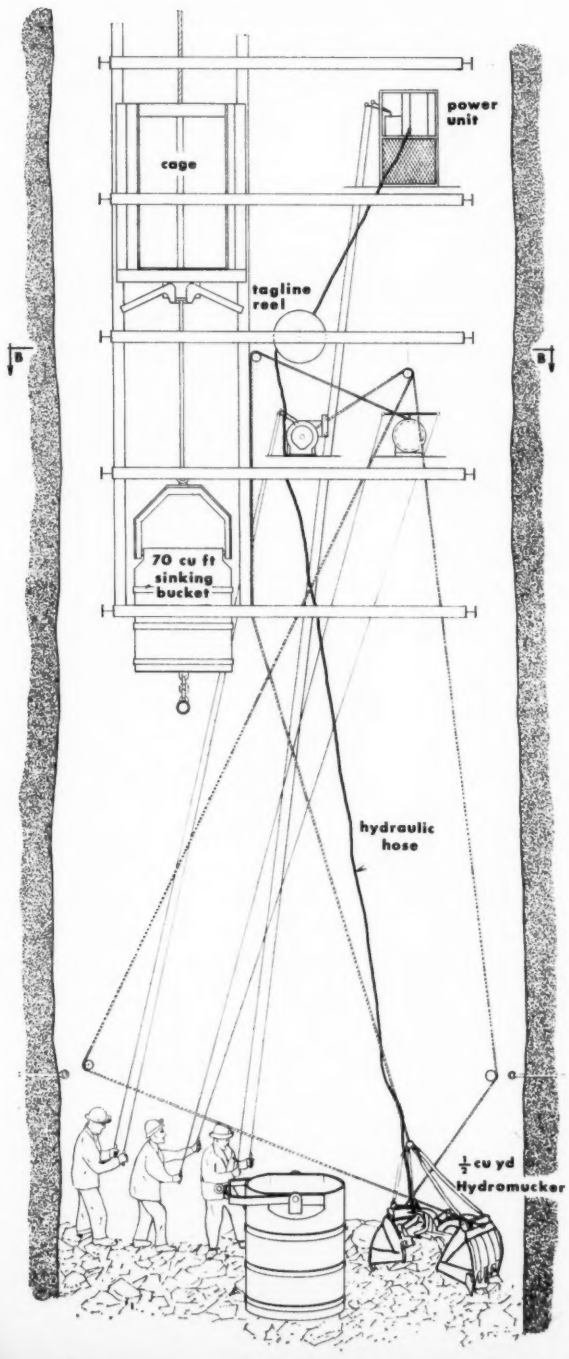
1. Stripping was started 12 ft below the bottom of the shaft so that a rock wall would be over the stripping crew.
2. Before stripping work began, a screen was lowered into the shaft to cover the pilot raise. The screen was raised when a round was blasted, and lowered again before the men went down on the bench. Safety belts and ropes were also used.
3. The drill jumbo was equipped with four screw jacks to brace it to the wall. As an added precaution, four chains were fastened from the shaft steel to the corners of the deck.
4. In order to safeguard against blasting accidents, extra precautions were taken to minimize the hazard and eliminate missed holes. Holes were wired in parallel and fired with 220-volt a-c. The wires of the caps were connected to a pair of 14-gauge bus wires which were fastened to two by two-in. posts set around the bottom of the shaft. The bus wires were connected to a reel of 12-gauge lead wires as the crew left the bottom. This reel was kept about 150 ft above the bottom, and was connected to a reel of similar wire by plug-in connectors when the crew was on the way up. The second reel was located on the ramp below the surface and was connected to a DuPont safety blasting switch when the crew was out of the shaft. Power from a 440-volt line went through a five-KVA isolating transformer, then into a circuit breaker, and finally into the blasting switch. The blasting switch was kept locked at all times except when the leadman threw the switch to blast. No blasting was done during an electrical storm.
5. After the round was blasted, the second shift cleaned off the bench with blow pipes using compressed air and water. The walls were thoroughly barred and rock-bolted.
6. A safety screen of expanded metal was suspended 13 ft below the last set at all times. The screen had an opening which allowed the bucket and the jumbo to pass through. When the crew was installing sets, the opening was covered with plank. It was lowered by means of a tugger hoist before installing the next set.
7. A trap door was used on the sill for loading timber and supplies.
8. The steel sets were lowered from the surface by a sling which was hung under the bucket. A complete set of steel and lacing was lowered in one trip. No one was in the bottom when any of the equipment was being lowered.
9. At 50-ft intervals, the shaft blocking was covered with a layer of scrap timber to break the fall of any rock which might become loosened.
10. Although the No. 5 hoist had a rated rope speed of 2400 fpm, the rope speed was kept below 1200 fpm for sinking operations. A limit switch was installed above the dump in the headframe to prevent hoisting too high in the headframe.
11. The cage and hoist were equipped with a two-way voice communication system in addition to the regular bell line.
12. A floodlight hung in the bottom of the shaft at all times except when blasting. The hoist engineer was required to blink the light and stop at the cage chairs until he received another signal to lower the bottom.

Safety was a major consideration in all of the shaft sinking jobs. The use of safety screens; trap doors at the collar; safety devices on the hoist and cage; safe blasting practice; and adequate ventilation, all contributed to the safety and efficiency of the job. Regular inspection of ropes and other equipment was an important part of the job. Hard hats, safety glasses, hard-toe shoes, safety belts and ropes are required in all Homestake underground work.

Shaft sinking with modern methods and equipment can be made just as safe as any other type of underground work, and it is no longer necessary to classify it as the backbreaking work which it was a few years ago.



PLAN B-B



ELEVATION A-A

Fig. 3. A Bucyrus-Erie Hydromucker was used for mucking at the Yates, Ross and No. 4. Due to the limited capacity of 3500 lb of the sinking hoist at the Yates shaft, the size of the bucket was restricted to 20-cu ft and a ⅜-yd clamshell was used. In order to eliminate placing the clamshell by manpower over the large area, a Gardner-Denver double-drum slusher hoist was set up on the shaft timber. Holes were drilled in the end walls of the shaft for fastening the sheaves. Ropes were attached to the controls on the slusher so that one man standing on the pile could place the clamshell anywhere on the muck pile. The clamshell was raised and lowered by a Gardner-Denver HKK single-drum hoist which was also operated by remote control. Three men were all that were required to do the mucking, the fourth man operated the dump and switched cars on the station. About 20 yd of rock per ft of shaft was mucked. When the large hoist was installed at the No. 4 winze, a 72-cu ft bucket was used for hoisting and a ½-yd clamshell for mucking. From 60 to 65 buckets were mucked each round; mucking time required about 1½ shifts

Fig. 4. While plans were being made for the No. 5 air shaft, it was decided to purchase a drill jumbo which could be used in either No. 4 winze or the No. 5 shaft. A six-machine jumbo designed by Ingersoll-Rand was installed in the No. 4 winze. The jumbo is equipped with hydraulic booms which mount DB30 Ingersoll-Rand drifters having ten-ft chain feeds. The deck of the jumbo is 4½ by 10-1/3 ft. It is equipped with four screw jacks to brace it to the wall and four chains that are fastened from the shaft steel to the corners of the deck. The jumbo was lowered on the hoisting cable, and when hoisted out, it was transferred to a traveler beam above the shaft collar. Only four machines were used at the No. 4 winze; all six were used at the No. 5 shaft

and lacing.

In order to cope with the heat encountered in sinking the winze, and future development work, an air conditioning unit was installed on the 4850 level. This unit supplies 20,000 cfm at 60° F. The air conditioner gets its cooling effect from the mine water supply which has a temperature varying from 39° F in winter to 52° F in summer. The air is carried from the conditioner down the winze by a 30-in. diam wood stave pipe.

Stations were cut at 150-ft intervals by the sinking crew, and the start of a development drift driven 25 ft from the shaft. The muck from the drift was slushed into the shaft and mucked with the clamshell. Steel bearing beams were installed at each station.

When installation of the Nordberg hoist was completed, an Ingersoll-Rand, six-machine jumbo was installed in April 1956 (see figure 4) and a burn cut round was used in place of a bench round. The round consisted of 65 to 70 holes depending on the type of rock. The length of the round varied from seven ft in hard rock to 8½ ft in softer rock. As a rule, a full shift was required for drilling. Only four machines were used in this shaft. The burn was drilled with 2½-in. bits on one-in. Q.O. steel, the other holes were drilled with 1⅜-in. bits on ⅞-in. hex steel. Chisel bits were used except for the burn holes. The holes were loaded with DuPont special 40 percent gelatin in the bottom, the balance was Gelex No. 2. All holes were fired with electric caps. Millisecond delays were used in the cut, and the balance were regular delays.

Mucking proceeded as described in figure 3. Footage per man-shift averaged 0.25 ft; the highest advance in one month was 97.5 ft.

The sinking was temporarily discontinued in September 1956 at 5700 ft so that development work could be started on the 5300 and 5600 levels. Sinking was resumed in June 1958 and completed to a depth of 56 ft below the 6200 level in March 1959. The drilling jumbo was in use at No. 5 shaft at the time, so sinkers were again used for drilling a bench round. Advance in this section averaged 0.35 ft per man-shift.

The Ross Shaft

As in the case of the Yates, the Ross shaft had to be kept in operation while it was being deepened. The bottom at that time was 65 ft below the 4100 level. A timber bulkhead was installed on the 4100 covering all but the cage compartment which was left open 50 ft farther down where a station was cut out for sinking hoist. The cage compartment was bulkheaded below this point.

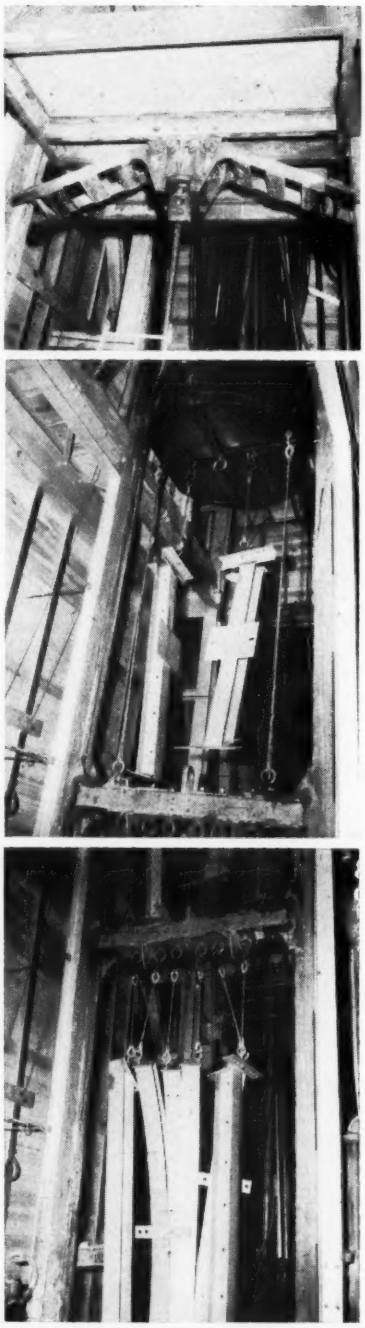


Fig. 5. An aluminum cage was used for a crosshead at the No. 5 shaft. The hoisting rope passed through a pipe in the center of the cage to the 72-cu ft sinking bucket. A locking device kept the cage and bucket together when traveling up and down the shaft (top). The cage stopped on chairs at the end of the guides in the bottom, and above the dump in the headframe. The bucket dumped by means of a ball-and-chain into a hinged slide which covered the shaft opening when the buckets were dumping. Steel sets were lowered by attaching them to rings and a crosshead under the bucket (middle and bottom). A complete set of steel and lacing (the lacing rode on top of the cage) was lowered in one trip

The Ross shaft has steel sets 14 by 19¼-ft o.d. It consists of one cage compartment, two skips, counterweight, manway, pipe and electrical compartments. The shaft is lined with 14-gauge corrugated steel.

The pilot raise was started on the 5000-ft level in July 1955 and completed in April 1956. The raise was 835 ft through to the bottom of the shaft.

The stripping method was similar to that used at the Yates and No. 4 shafts. The sinking hoist was set up in line with one of the skip compartments which was used for a hoistway. Men and materials were lowered on the big cage to the sinking station and transferred there to the sinking compartment. An aluminum cage was used for stripping.

Stripping was started in August 1956 and completed to the 5000 level in January 1957. A four-man crew, and three shifts were again used.

Footage per man-shift averaged 0.88 ft. The maximum footage in one month was 159.0 ft.

The shaft was sunk 48 ft below the 5000 to provide room for a skip spillage pocket and pump sump. A bench round was used in drilling, and the Hydromucker was used for mucking.

Footage advance averaged 0.24 ft per man-shift.

No. 5 Shaft

The No. 5 shaft is circular, and has steel sets which are 19-ft outside diam. The sets are on 10-ft centers, and are laced with corrugated, galvanized steel. During development operations the shaft had four compartments consisting of a large cage compartment for sinking, a smaller service cage compartment for future use; a manway, and a pipe compartment. Sinking and stripping were finished in June 1959, and now work is in progress to remove the temporary divider in the ventilation compartment and install corrugated iron lacing between the ventilation compartment and the service cage-manway-pipe compartment. When lacing, which is progressing at the rate of 150 to 180 ft per day, is complete, 60 percent of the shaft will have unobstructed air flow as the lacing is flush with the inside flange of the steel. The other compartments provide an emergency exit, and allow

room for installation of air conditioning pipes in the future.

The shaft is connected to the hoist room and compressor building by a ramp which is 10 ft below the surface. The ramp provides an enclosed walkway to the change room, and carries the air and water lines and electrical cable to the shaft. The headframe is enclosed around the collar of the shaft and equipped with heaters to prevent freezing in the winter while sinking.

Drifts were driven from the existing workings in the mine on the 2000, 2900, 3800, 4700, and 5000-ft levels to the shaft site. Pilot raises were then driven the 900 ft between drifts. The raise above the 2000 level was scheduled to go 1200 ft, but unfavorable ground conditions made it advisable to stop it at 935 ft. This left 970 ft to be sunk from the surface.

Construction work was started on the surface during late summer of 1956. The shaft was sunk 60 ft and stopped to allow for installation of the headframe, hoist building, and installation of the hoist. Sinking was resumed in June 1957. The crew consisted of 12 shaftmen who were on contract pay, a shaft foreman, truck driver, maintenance man, and three hoistmen. The shaft jumbo (figure 4) which had been used at No. 4 winze was equipped with six machines. At the start, six men were used on the drilling shift; three men on the mucking shift; and three men on the third shift installing steel sets. A regular cycle could not be held, however, so the crews were divided —four men on each shift, and each shift did whatever was in order.

Two 6000 cfm fans were used for ventilation through 16-in. ventube and pipe—one for exhaust, and one for blowing. Very little time was required to clear the shaft air after blasting.

An aluminum cage was used for a crosshead. (See figure 5 for more information).

An Allis-Chalmers double-drum hoist was moved to the No. 5 shaft from the Ellison shaft. It is equipped with a Lilly controller, overwind and overspeed controls, and other safety devices common to hoisting equipment. The hoist has a capacity of over 20 tons rope pull, a drum capacity of over 5000 ft of 1¼ in. rope, and a rope speed of 2400 fpm.

The shaft is in Pre-Cambrian rock throughout. It consists of schist, slate, quartzite, amphibolite, and some rhyolite. A burn cut round was used which required from 90 to 110 holes. Integral, ⅞-in. hex steel was used. A 9¼-ft steel could be run without changing. The burn holes were drilled with 2½-in. threaded bits. All bits had carbide inserts. All holes were collared with 2½-in. bits to allow for inserting a short piece of two-in. casing.

Fig. 6. In the No. 5 shaft, an Eimco 630 tractor-loader was used for mucking into two 72-cu ft buckets. A crosshead was suspended from the sinking bucket by cables. The loader was placed under the crosshead by a traveler hoist and bolted to the crosshead. Two men worked in the bottom when mucking; a third man watched the pumping and got material ready for hanging steel; the fourth man operated the bucket dump. About 70 buckets were mucked each round—65 buckets, or 260 tons have been mucked in an eight-hr shift. A regular pattern for rock bolts was drilled with the round. In shattered ground, two-in. mesh cyclone fencing was bolted to the walls. Drilling and rock-bolting usually required a full shift

The holes were drilled in a circular pattern around the cut and were loaded in the manner described for the No. 4 winze. The location of the cut was altered on each round.

An Eimco 630 tractor-loader was used for mucking. (For more description of this operation see figure 6).

A complete set of steel and lacing was lowered in one trip. (See figure 5). The wall plates consist of four circular sections of six-in. H-beams bolted together. The studdles are 2½ by 3½ by ⅜-in. angles; dividers are also six-in. H-beams. The sets were aligned and held in place temporarily by screw jacks.

As in the other shafts with steel sets, blocking consists of cement-sand mortar contained in 12 by 18-in. muslin bags.

Bearing beams were installed at 300-ft intervals. The beams were cemented into hitches cut in the rock. Midway between bearing beams, anchor rods were cemented into holes drilled in the walls and bolted through weep holes in the wall plates.

Corrugated lacing two ft wide and 10 ft long was fastened to the steel with clips. It took about four hr to install the steel lacing.

The first 300 ft of shaft was concreted, and another section from 850 to 1040 ft was also concreted. The concrete was used where water fissures had to be sealed off, or broken-up ground was encountered. Corrugated lacing was used for concrete forms. It was braced by three rings of six-in. channel iron which were in turn braced radially with timber. The air-entrained concrete was hauled from a central mixing plant by truck. The trucks dumped directly into a 72-cu ft bucket which had a six-in. spout in the bottom. About 30 to 35 yd of concrete were poured per set. The form lacing was salvaged when the concreting was finished.

The shaft broke into the pilot raise in April 1958. A very commendable job of surveying brought the two together almost on dead center.

In stripping, holes were drilled around the pilot raise on a 2½ to 3-ft spacing and the rock blasted into the pilot raise. Some of the rock was used for backfilling stopes. A crossbar was added to the base of the jumbo to straddle the pilot raise when set up for drilling.

Stripping at the No. 5 shaft was completed to the 5000 level in June 1959. The advance averaged about 300 ft per month, or 1.42 ft per man shift. The maximum advance in one month was 404 ft, in contrast to 136 ft per month which was the most footage obtained by sinking. The 4900 ft of shaft—970 ft sunk and 3935 ft raised and stripped—was completed in less than two years from the time sinking was started.

The Economics of Large SHOVELS

The development of larger stripping units has had great impact on the coal mining industry. Two authorities on strip mining team up to discuss how recent developments in design have influenced the choice of equipment. One concentrates on shovels, emphasizing that operators have never bought a shovel that had too much capacity. The other considers the use of draglines, and notes that a point is approaching in the design of these units where a complete redesign will be necessary if materially larger machines are to come forth

By JAMES P. McDOWELL,
Superintendent, River King Mine
Peabody Coal Co.

"Big Paul, The King of Spades," is working at Peabody Coal Company's River King mine near Freeburg, Ill. This Marion Type 5760 stripping shovel can fill its dipper with 105 tons of overburden, move it about a city block away and dump it on a bank 100 ft high. Use of larger shovel units is a must for large volume producers because of the dwindling reserves of shallow overburden and low ratio coal

THE U. S. coal industry mined approximately 400,000,000 tons of coal in 1958. Of this, slightly more than one-fourth was produced from strip mines. The coal mined by strippers has been increasing, percentagewise, since the first team pits, and old steam shovels began the open cut method, many years ago.

Strip mining has increased and expanded because it could produce coal at less cost than underground mining. The stripping industry was born by the advent of mechanization of earth moving tools, while now the industry is one of the leaders in promoting and fostering the advance of mechanization. Productivity per man is much higher than in underground mines, and has been increasing almost in the same ratio as the bucket capacities of the shovels have increased. This increasing productivity of strip mines has no doubt aided in the wave of mechanization that has been increasing in underground mines for several years. Through advancements in mechanical mining techniques, underground mines are rapidly closing the gaps of productivity and costs that have separated these two methods of mining in previous years. Forty to 50 tons per man-day will rapidly become no exception underground and the strippers are beginning to see the end of their domination in the productivity advantage and mining costs.

The strip mining group knows that this country's shallower overburden reserves have been fairly well de-

(*Continued on page 60*)

Stripping Equipment

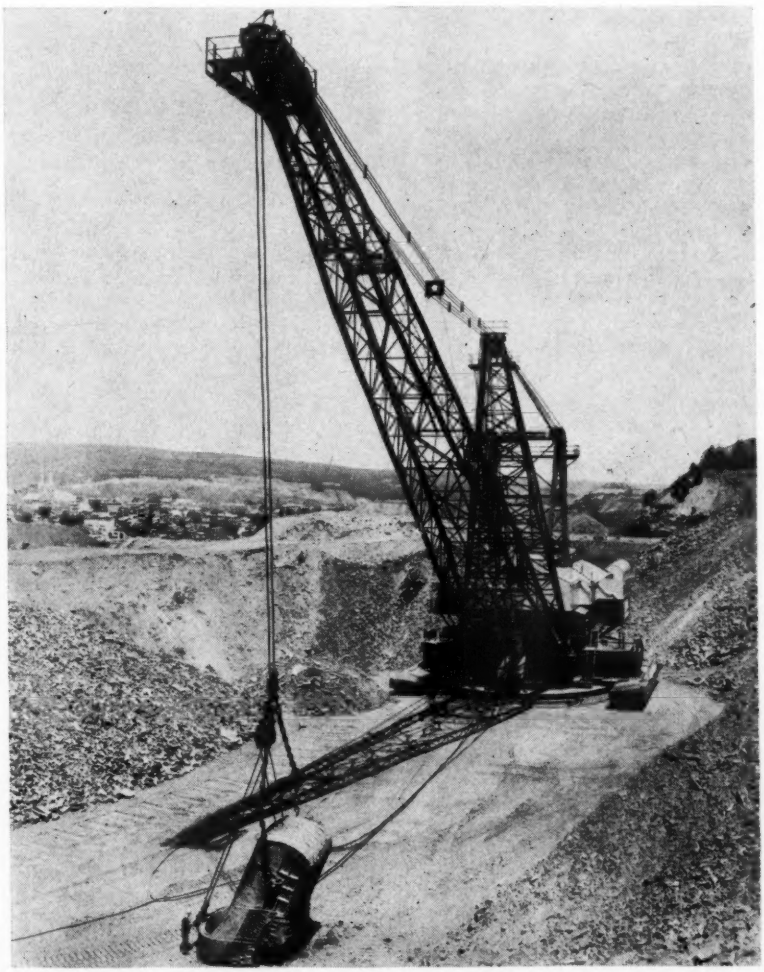
DRAGLINES

By LAFE STEWART, Chief Engineer, Maumee Collieries Co.

THERE have been many changes and improvements in stripping procedures over the past ten years. Use of larger draglines and shovels has been necessary to meet ever rising costs, but has also required a larger capital investment. In many cases this requirement of heavy investment has brought about mergers and consolidation of producing companies in order to provide adequate reserves over which to amortize this capital expenditure.

Selection and purchase of a stripping unit is controlled by many factors and conditions which are completely individual to the territory to be considered. The most important requirements which must be met are as follows.

1. Adequate reserves must be available to amortize the investment.
2. A market must be available to give adequate working time.
3. Transportation must be available to reach the market.
4. Realization must be sufficient to show a profit.



An example of the trend toward larger equipment is Gilberton Coal Company's dragline near Shenandoah, Pa., which carries a 32-cu yd bucket on a 200-ft boom

Certain Conditions Favor a Dragline Over a Shovel

There are certain conditions of both surface and coal topography which sometimes preclude the use of a shovel as a stripping unit. If the coal reserves lie in various scattered small bodies or if the coal seam itself is very rough in character or thin, selection of a dragline is clearly indicated. The dragline moves overland with much less difficulty than the shovel; therefore, substantial savings are possible in cases where reserves are not in one contiguous body, but are separated into several individual tracts, each of which requires initial box cuts and development. The dragline is a far more effective tool for box cuts due to its mobility and longer reach. It also is useful in development of roads and heavy ditching, doing the work quicker and at less cost than smaller and slower equipment.

If the coal seam is very rough, the dragline can remove all the overburden and prepare the coal for loading, while the shovel, which travels on the coal, is frequently required to leave material for removal by the loader in order to maintain a level travelway.

In the case of thin seams, a large shovel is often too heavy for the load bearing capacity of the coal seam. The result is periodic breakthroughs and some loss of top coal due to breakage.

Development of large shovels has progressed to the point where 60 to 80-yd long-range machines are available. These machines require large contiguous bodies of coal and represent an investment in excess of $3,000,000. If the front end combination is designed for maximum

(*Continued on page 61*)

(*Continued from page 58*)

pleted, and future coal production by stripping must be from high ratio and deeper overburden reserves. In addition to the higher ratios resulting from deeper overburdens, the strip operator is not only confronted with the increased efficiency and lower production costs of underground mines resulting from the development and use of continuous mining machines and the application of other highly mechanized units, but the deeper overburden is taxing the physical size and weight of the stripping shovels to handle these depths.

Both Marion and Bucyrus have developed stripping shovels with larger dippers and greater ranges than were formerly obtainable, and the acceptance of these units by the industry is tangible evidence that they are performing an economical service. These new units have booms 140 to 165 ft long, and dipper sizes range from 55 to 70 cu yd. Weighing 2000 to 3000 tons, these newer machines have been built with the strongest alloy steels to carry the enormous loads that the large buckets and ranges demand.

In the past, manufacturers built the 5480's and the 750-B's to carry a 12 or 14-yd dipper and the operator's first bucket replacement would be an 18 or 20-yd. Bucket increases have been common to the industry throughout the time of the introduction of the 750-B Bucyrus and the Marion 5480 shovels. Operators have not only never bought a shovel which was too big, they have never bought one with enough capacity.

This is really an economic drive or manifestation to uncover the coal more rapidly to lower mining costs.

70-yd Shovel vs 13-yd Shovel

To compare the economic aspects of the larger stripping shovels with the 20 to 25-year-old machines that are still operating, in a reasonably thorough manner, consideration should be given to several of the major phases of shovel application. Although they may not be truly descriptive and there will be some overlapping between them, let us designate them as *output capacity*, *operating ranges* and *stripping costs*.

An analysis of this kind should be one of comparisons and for this purpose let us choose a Marion 5320 and the latest Marion Type 5760. The writer could use as well the Bucyrus 750-B, or 950-B, and the 1650-B which compare in capacity and size with the Marions, but his information is somewhat more complete with the 5320 and the 5760. The type 5320 is equipped with a 95-ft boom and a 13 cu yd dipper and the Type 5760 with a 140-ft boom and a 70 cu yd dipper. In some parts of this comparison study, it may be considered unfair to judge the 30-year-old Type 5320 with the two-year-old Type 5760, but the 5320 was a very popular type and many companies are using the older and smaller shovels for their stripping operations. This comparison will help us to judge the economic aspects of the larger machine.

Output of Larger Unit 4.4 Times Greater

During the entire year of 1936, the Type 5320 shovel—at Hume, Mo.—removed a total of 4,322,930 cu yd of overburden for an average of approximately 360,000 cu yd per month and 600 cu yd per digging hour. The average overburden depth was about 33.5 ft. From September 1957 to September 1958, the Type 5760 shovel (at Peabody Coal Company's River King Mine) removed a total of 18,984,730 cu yd of overburden for an average of 1,582,000 cu yd per month or 3250 cu yd per hour. The average overburden depth for this period was 61 ft.

Thus, the average output of the Type 5760 is approximately 4.4 times greater than the Type 5320. Based on a three-man crew and the same labor scale, the direct operating labor cost per cubic yd for the Type 5760 is only 24 percent of the direct operating labor cost of the smaller machine.

Operating Ranges

The operator ranges of the Type 5320 are much less than those of the Type 5760. When making straight cuts of equal width in a level terrain and stripping 4-ft coal, the calculated maximum overburden depth that can

Today's big shovels permit companies to have larger, more efficient one pit mines. Result—lower fixed costs.

be spoiled by the Type 5320 is about 48 ft. Under the same condition, the maximum overburden that can be spoiled by the Type 5760 is 66 ft.

Based on these figures the maximum overburden depth that can be spoiled by the Type 5760 is 37.5 percent greater than the older machine. Thus, the Type 5760 will make available for stripping reserve areas that could not be handled by the Type 5320 alone, or mined economically by a tandem operation of this shovel and other auxiliary units. Of course, the 66 ft depth of the larger shovel is not deep enough, but with its larger capacity and an auxiliary unit of the excavating wheel type that also has a high output capacity and a deep operating range, the combination will be ideal to economically mine reserves that a few years ago were beyond industry's possibilities.

Cost of Moving a Cubic Yard of Overburden

Because it is not possible to obtain actual operating costs for the comparison of these two machines in the same pit, cost comparisons must be made from estimated costs. The estimated operating costs have been prepared on the basis of the following:

1. Labor—Assume the same for both shovels as shown on the following schedule.
2. Electric Power—Cost equals $0.0125 per kwh.
3. Maintenance—For the Type 5320 over a 12 to 15-year period, a cost figure of $0.03 per cu yd has been used, which is a reasonable average. There are no long time averages available as yet for the Type 5760. Because of such things as modern design, welded construction and better steels, it is reasonable to assume an average maintenance cost of $0.025 per cu yd for the Type 5760.
4. Amortization—It is assumed that the Type 5320 has been completely written off at this time and there would not be amortization charges applicable to this unit. The *guessed* present day installed cost of the Type 5760 is $3,300,000, and amortizing this over 15 years of 11 months of 720 operating hours each, the amortization charges on this unit will be $27.78 per operating hour.

The following tabulation shows the estimated operating cost for the two shovel units covered by this analysis study:

			Type 5320	Type 5760
Operator	@	$4.5000	$ 4.50	$ 4.50
Oiler	@	4.0000	4.00	4.00
Pitman	@	3.7500	3.75	3.75
200 kwh	@	0.0125	2.50	—
1000 kwh	@	0.0125	—	12.50
Maintenance	@	0.0300	15.00	—
Maintenance	@	$.0250	—	56.50
Amortization			—	27.78
Total Per Hour			$ 29.75	$109.03
Cu Yd Per Hour			500	2250
Per Cu Yd			$ 0.0595	$ 0.0485

Based on the figures in the tabulation, the Type 5760 can uncover coal at 24 percent higher ratio at the same cost per ton as that of the Type 5320. This will be similarly true if a Bucyrus 750-B and the new 1650-B are used and their costs compared in equal overburden.

Evaluation of Intangibles

It should be noted that the estimated cost figures do not include administration, supervision, interest, taxes, insurance or any other items of general overhead that must be taken into consideration when determining the total cost of moving a cubic yard of overburden.

In addition, the direct savings resulting from many intangibles should be credited to the larger unit. Many of these intangibles are greater than the direct savings that can be shown, such as being able to recover more of the reserves on company owned property and being able to uncover coal to meet changing market conditions. Other advantages are:

A) Use of the larger shovel will enable an operator to extend his strip reserves in a given acreage and thereby obtain approximately 100 percent recovery from more of the coal in place rather than recover only 50 percent by augering or punch mining. The company has never been able to really determine how this additional tonnage should be capitalized. It should be at least the royalty payable or the depletion allowance per ton of extra coal recovered, because the coal land cost has already been absorbed.

B) The larger shovel will enable a company to have a larger one pit mine equipped with efficient over-all mining and preparation facilities. This will result in lower overhead and general expense that is not controllable per ton of coal produced.

C) The big mine, with a larger shovel, must have adequate long time reserves to justify the expenditure and this condition is attractive to large contract users of coal. Long term coal contracts, with relatively small sales and expense, can be made with such customers which will result in an added profit of longer duration.

D) Use of larger shovel units is a must for large volume producers because of the dwindling reserves of shallow overburden and low ratio coal. To continue profitably in the coal stripping business and make that *keeping* money, it is necessary for progressive and far seeing operators to tool up with the latest high producing equipment that is available.

E) These large shovels are expensive, but when they can be amortized over longer terms, they can be justified if all of the intangibles can be evaluated. Operators have never yet bought a stripping shovel that is big enough or too big for their job.

DRAGLINES (*Continued from page 59*)

yardage, their reach is frequently inadequate for deeper portions of the stripping area and, consequently, a secondary helper machine of some sort must be provided, adding materially to investment required and to operating costs.

Trend Has Been Toward Longer Booms, Smaller Buckets

Development of large draglines has lagged behind that of shovels. This is probably due to their limited use, except in the last few years, and also due to the fact that for many years there has been a tendency to consider the dragline as primarily an auxiliary machine rather than a prime stripping unit. However, draglines are now available with approximately 40-yard capacity and with a dumping radius of around 200 to 220 ft. Such a machine can strip up to 120 ft of overburden without an auxiliary machine and with only about 12 percent rehandling in stable overburden. This would only be possible, however, by taking advantage of additional reach created by filling the pit and rehandling the wedge of fill against the highwall.

There has been a tendency, both by the builders and users of draglines, to lengthen the booms and use smaller buckets in order to create longer reach rather than to use the method of filling the pit to create additional reach. The net result of this practice has been to limit the production potential of these machines in coal stripping practice.

A point is approaching in the design of draglines where a complete redesign will be necessary if materially larger machines are required. One of the limitations concerns available wire rope sizes, now limited to 3⅛ in.

Production Figures Cited

There has long been a bone of contention between users of shovels and draglines as to the relative efficiency and production costs realized. One of the main arguments put forth for shovel stripping states that shooting of overburden may be much lighter and less costly for the shovel. This argument has merit because everyone in the industry agrees that this is true to some degree in nearly every case. With this probable exception, however, Maumee Collieries Company's own experience with drag-

Maumee Collieries Company's Old Glory mine No. 17 in Clay County, Ind., marked one of the first applications of draglines to open cut bituminous coal mining. A 13-yd bucket was employed on the walking dragline pictured above. Draglines are now available with approximately 40-yd capacity and a dumping radius of around 200 to 220-ft

lines over the past 23 years indicates that draglines of 25-yd capacity or over are equal yardagewise to shovels of like bucket size. The company now operates three machines with 29-yd buckets which produced in excess of 1,000,000 yd each for three consecutive months last winter. Hourly net yardages were between 1600 and 2000. This production compares favorably with production figures of like shovels.

Based on the experience records of these machines, draglines now available with 40-yd capacity should produce in the neighborhood of 1,350,000 cu yd per month when provided with proper bank preparation.

SELECTION OF SUPERVISORS

(*Continued from page 51*)

programs for a short period and, as a consequence, has rather limited knowledge of the results. During this time the company has seen three different programs: (1) an outright grant to a student for four years at a stipulated amount for each year continuation based on a C+ average or better; (2) a year-to-year grant with no obligation for continuation on grades or any other basis—usually starting with first year students, then, with drop-outs, picking up another student in the same class who appeared to be a likely applicant for permanent employment following graduation; and (3) stipends to upper classmen showing most promise and most likely to seek employment with Truax-Traer following graduation. Usually the stipend to the third group was about double that given in programs one and two. The mortality in all three, so far as ultimate employment is concerned, is very high in spite of the fact that summmer work is provided. The wash-out in freshman and sophomore years is discouraging but not without return for the company knows it is helping young men through the first two years who could not otherwise attend school.

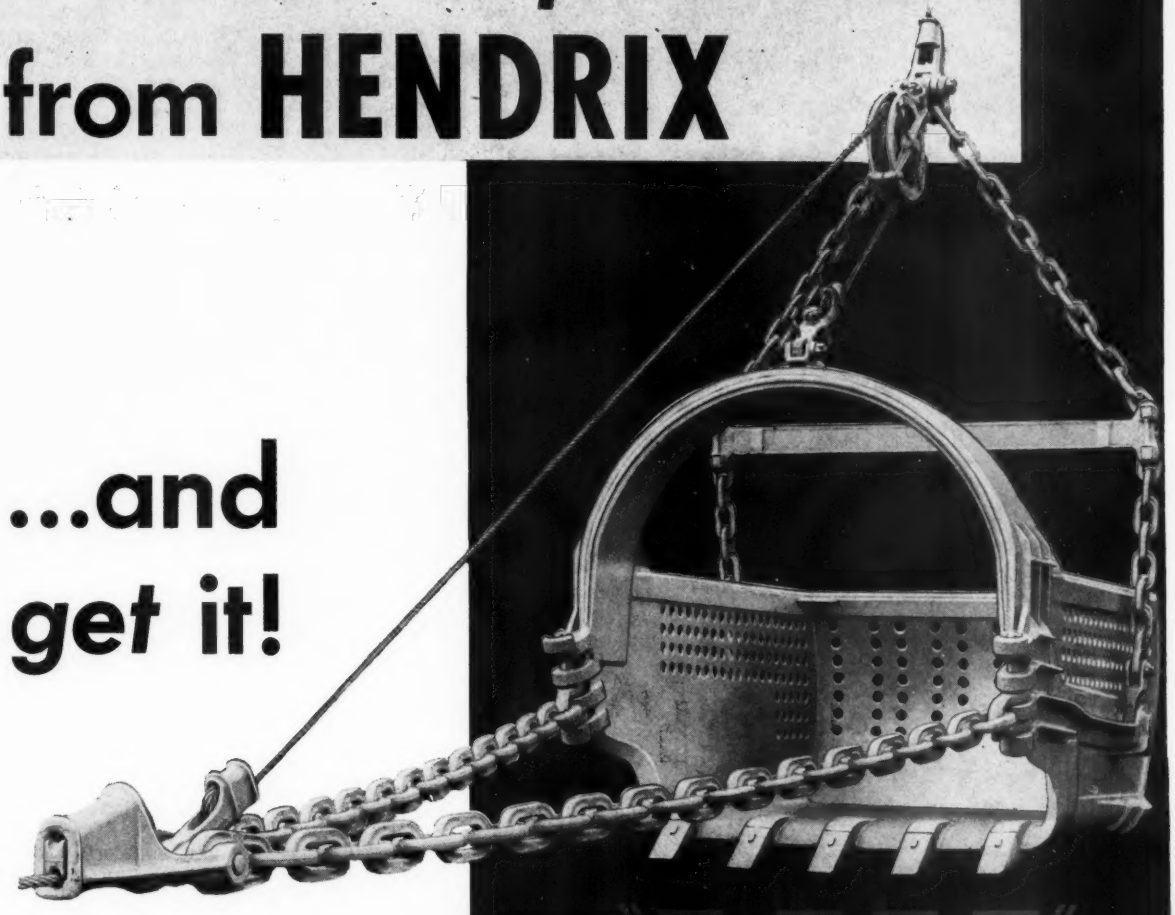
Considering the three programs mentioned above and the Co-op Program (Antioch), which appears to be spreading widely, it is believed that the industry could best spend its scholarship dollars by choosing scholarship candidates from seniors in high school and offering them summer work underground before their freshman year in college (if they are 18 years of age). Thus, a prospect's adaptability for underground employment before college entrance could be determined. This would carry with it an understanding that the candidate's freshman year in a Co-op program would be financed if he had underground adaptability. At the end of a 12-month period, the company would have a fair idea about a candidate's scholastic ability. If, however, the student were not 18 upon graduating from high school, his underground adaptability would not be known until after the completion of his freshman year, but the company would know about his scholastic ability which may save an unnecessary three months on the payroll as a student employee. After the first year the student would then enter into the true Co-op program of equal time in school and on the job —in one sense a self-financing education.

For the writer to say that a scholarship program as outlined above should be on an industry basis or on a company basis is not possible because he does not have all the facts nor the experience. However, it must be said that the few who are now in scholarship program participation cannot and should not carry the load for the industry. Investigation of the problem is suggested both from the program angle as well as financing.

As a parting shot, stabilization of the industry's employment level would do much to improve the supervisory level.

You can expect more from HENDRIX

...and get it!



HENDRIX
Heavy Duty **Mining Buckets**

Built for dependable heavy-duty service under all stripping conditions

4½ to 14 Cubic Yards With or Without Perforations

HENDRIX MANUFACTURING CO., Inc.
MANSFIELD, LOUISIANA

Hendrix DRAGLINE BUCKETS

HIGHER ARCH · WIDER FRONT · TAPERED BASKET · GREATER STRENGTH

Lower Cost Quarrying through AUTOMATION

By J. E. DOYEN
Principal Electrical Engineer
Western-Knapp Engineering Co.

The object of this informative article is to review basic production-tested applications of automation in quarrying operations. Plant operators—from those striving to reduce costs by modifying an existing plant, to those planning an entirely new installation—will find this article a valuable background study of the subject

THE object of this paper is to review production tested and proven basic applications of automation in quarrying operations with the thought that to some degree it will be of interest and value to everyone —from those who may see a method for reducing costs by limited specific applications to those interested in the more comprehensive installations.

The purpose of automation in quarrying operations is to enable the owner to utilize his equipment and personnel to the maximum extent possible consistent with the design ratings of the properly applied equipment and efficient employment of the personnel—in short "cost reduction through automation."

Automation can be applied to economical advantage in practically all plants regardless of their physical magnitude. It can be comprehensive and cover practically all phases of the operations, or it can be limited to individual specific problem areas.

The comprehensive application is generally limited to new installations, while the application to specific problem areas usually applies to existing facilities. However, this does not imply that existing facilities can not economically be converted to automatic operation. Every operating facility has its own peculiar and distinct problems which may be entirely different from a seemingly similar plant, and only a realistic factual appraisal of those problems by the owner can determine the desirability or feasibility of the application of automation. It is felt that many operators live with problems which they consider normal routine operating problems without giving more than a fleeting thought as to what could be done to eliminate the condition by a relatively simple and inexpensive application of a form of automation.

Automation Provides Many Desirable Features

The practical application of automation provides built in protective features to all parts of the system. These features provide optimum safety to personnel and equipment, correct operating sequence of equipment, close control of components in specification mix products, maximum production by continuous maximum loading and minimum down time, and flexibility of operations for including optional equipment into process circuits to keep the plant in balanced and continuous operation. Although these features will be obvious as we proceed through the paper, they are mentioned here to serve as a guide in noting the emphasis placed on these features in detailed descriptions that follow.

The most economical solution to the scope of application of automation varies with each installation. Just as there is no fast rule that can apply to overall arrangement of plant facilities, there is no fast rule that can apply to the degree of automation that is economical. However, there are basic applications that can be seen in the modern facilities which might be considered necessities if they were understood by the owner contemplating a new installation. At least with the knowledge of what is available and production tested, the owner has the opportunity to consider the advantage or disadvantage of the use of such systems.

In the following presentation of the basic features of automation no attempt is made to describe the facilities of any one particular plant. The purpose for this is to cover a wider variety of applications and yet keep it basic.

In order to obtain the most efficient operation, the trend today is to divide the plant into several separate and, for a limited time, independent operating divisions by the use of surge and storage piles or bins. This

sectionalization permits a controlled continuous load on the equipment in the separate divisions, independent of the fluctuating loading at the pit and temporary shutdowns in other divisions. Control of these divisions is from centralized control panels located at points where an operator is considered desirable for purposes of routine maintenance and human supervision of equipment. These stations are generally crushers and major screening operations. Depending on the operations, one man may have two or more centralized control panels under his direct operation. A sand and gravel plant at Crystal Lake, Ill., is a good example of this type of operation. The operator located in the screening tower controls the flow of material from the primary surge pile through the secondary crusher and screening operations into the sized product storage piles. He also controls the blending operations and loading into the load out bins. In addition he controls a rod mill and sand plant operations including stacking with a radial stacker and loading from there into the load out bins.

Electrical System Corresponds To Plant Operations

The basic electrical distribution system should be designed to correspond to the sectionalized plant operations. An electrical feeder serving one section or division of the plant should feed either all or none of the components of a different section.

The electrical power distribution system for the pit equipment should be isolated from the main plant system, and a 50 ampere neutral grounding scheme is recommended for the pit circuits.

Figure 1 shows a distribution system and neutral grounding scheme that affords protection to system components and personnel with sufficient advantages to justify the use of the isolating transformer for the pit circuit. The protective ground circuit for the pit should be designed for a maximum over-all impedance of a value which will produce not more than 100 volts drop for a solid ground fault, and the relaying scheme should be such that the ground faulted equipment is relayed off the circuit without disturbing the remainder of the system.

For those operators who do not desire to immediately relay ground faulted equipment off the circuit in the main plant, the 600 ampere resistance shown in figure 1 can be changed to a high resistance value. This system is being used today in refineries where unscheduled shutdowns can be very costly.

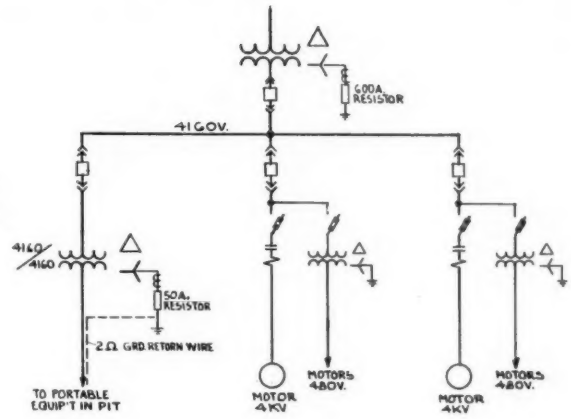


Fig. 1. Recommended neutral grounding scheme for quarrying operations

In other words there is a sacrifice of maximum protection to equipment for the ability to continue operating with one ground fault until a controlled shutdown can be made.

Four General Systems Described

In order to illustrate the features we want to present we will describe the following systems which are totally unrelated to any one particular plant.

1. A primary system starting with the material being loaded and conveyed by portable feeders and conveyors from the quarry floor to the scalping screen and primary crusher located outside the pit, and then to a storage pile
2. A secondary and tertiary crushing system starting with loading the bins ahead of the crushing and conveying to screening plant
3. Screening plant and sized product bin storage
4. Blending of sized products and loading into loadout bins

In the automatic plant, the equipment is sequence interlocked to prevent spillage of material and damage to equipment. Two types of sequence operations, permissive and automatic, will be noted in the descriptions that follow. In permissive sequence operations, the equipment is interlocked in such a manner that each piece of equipment is started individually but can be started only after the equipment which it loads onto has been started. After the equipment is running and any individual unit stops, everything loading onto this piece of equipment automatically stops, with this process continuing automatically back down the line to the beginning of the process. In automatic sequence operations, the equipment is interlocked in such a manner that with the start of one piece of equipment the unit feeding this equipment is automatically started with this process continuing automatically back down the line to the start of the loading. If any piece of equipment stops, everything feeding that piece of equipment automatically stops. To permit tests and also to keep the plant in operation if a fault develops in the interlocking system, a selector switch is provided for each piece of equipment. The selector switch can be set on the automatic position for normal operation with all the interlocking in the circuit or it can be set on manual to bypass the interlock system. It is recommended that a red pilot light be provided to show when the selector switch is set on manual.

Figure 2 shows a basic central control panel pushbutton and pilot light arrangement used for each individual piece of equipment. With the selector switch in automatic position, the local start-lockout stop pushbutton at the motor provides only a test start operation with the start button. The equipment will run only as long as the start button is held in the depressed position.

Figure 3 is the legend for the sequence diagrams that will be described.

These material flow and sequence lines are painted on the central control panels.

Primary system: To describe the primary system mentioned previously we will begin with the sequence interlocking diagram, figure 4 (A). All of this equipment is under the control of, and is operated from, a central control panel located at the primary crusher. Figure 4 (B) shows the control panel. With the selector switches on the central control panel

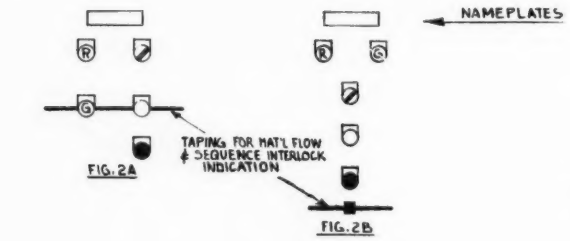


Fig. 2. Basic central control panel pushbutton arrangements for individual pieces of equipment

in the automatic position, conveyor 7 is started first, the crusher is then started, the screen next, and then conveyor 4. With the start of conveyor 4, conveyors 3, 3A, 3B, etc. and feeder 2 start automatically, one after the other in the order from 3 to 2.

The portable conveyors are designed such that they may be used in any order without changing any wiring. Regardless of the order of use of any particular conveyor the interlocking and automatic operation will remain as required.

The controls for conveyor 4 are on the central control panel. Conveyors 3, 3A, etc., which are started automatically with the start of conveyor 4, have all their manual controls on each individual conveyor. Figure 4 (C) shows the electrical equipment on each of the portable conveyors. Each of the portable conveyors is wired in such a manner that the portable feeder may be plugged into receptacles on either end of the conveyor for feeding onto that particular conveyor and still maintain the automatic feature. Each portable conveyor, as all conveyors mentioned in this paper, has an emergency stop switch operated from a $\frac{3}{16}$-inch stainless steel airplane wire strung from one end of the conveyor to the other on the walkway or normal maintenance side. A pull on this airplane wire will operate a maintained contact limit switch and stop the conveyor. The conveyor can not be started again until someone manually resets the limit switch.

Secondary and tertiary crushing system: A secondary and tertiary crushing system made up of a battery of crushers is generally controlled from a central control station. Following is a brief description of a modern system with the layout such that the crushers can all be operated as secondary crushers with the option to use part of them as tertiary crushers by returning material from the screening plant. The operator controlling the crushers also controls the scalping screens and bin loading operations ahead of the crushers, the crusher feeders, the crushers and their auxiliaries and the single collector belt running beneath the crushers which feeds the belt conveyor to the screening plant. The surge bins ahead of the crushers are loaded by a tripper which shuttles back and forth above the bins. When all the crushers are operated as secondary crushers, the shuttle is set by the central operator at the control panel to continuously shuttle back and forth above all the bins. Bin level indicators, located in positions to give high, medium and low level indications at the central control panel, also give the signal to automatically spot load any bin that gets low. When part of the crushers are used as tertiary crushers, the operator sets the tripper controls to shuttle across only those bins feeding the secondary crushers with the same automatic feature for spot loading the low bin. The tertiary crusher bins are then loaded from the return belt from the screening plant. The central operator feeds the crushers by presetting a "Dynamic" feeder system to control the feed at a certain rate automatically controlled by the crusher loading, as determined from the current drawn by the crusher motor. The controls are located on a platform level a few feet above the tops of the crushers. A central signal and auxiliary control panel contains the indicating lights for bin levels, tripper positions, lube oil flow alarms, lube oil high temperature alarms, tripper full chute alarm, audible alarm test and silencer pushbuttons and the indicating lights showing the individual equipment in operation.

Bin storage system: The screening plant and sized product storage bins are under the control of a central control operator and panel in the screening plant located at a level to permit minimum walking distance for visual inspection of all the screens. Motorized flop gates are provided for diverting the flow of material from the sized product bins to conveyors carrying the product back to the crushing plant bins. The flop gates are controlled from the central control panel and can be operated without shutting down the operations.

The central control panel contains all the pushbuttons, selector switches, and indicating lights for equipment operation, the indicating lights for high, medium and low bin level indications, and the flop gate position lights. Permissive sequence interlocking is provided. Blocking plates are provided in certain chutes for the purpose of operating the plant at

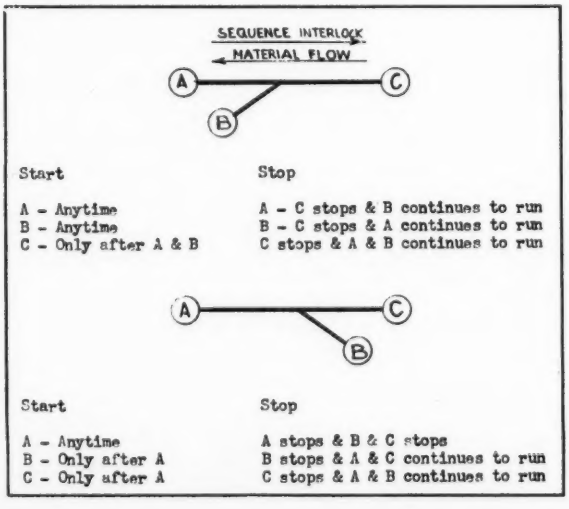


Fig. 3. Legend for sequence interlocking diagrams

reduced capacity with a complete shutdown of part of the screens. Limit switches are provided at the chute blocking points to automatically provide a complete equipment sequence interlocking system when the blocks are in place.

A full bin is noted by both a visible and audible signal, and a time delay is provided on high bin level signal before automatically shutting down the operation. The time is sufficient to permit the operator to divert that particular size product back to the crusher bins if he desires and thus avoid an automatic shutdown. This feature provides a means of keeping the plant in operation during a temporary unbalance of operations.

Major conveyor belts in this system, as in all the divisions are protected by centrifugal switches, chain driven from sprockets on the tail pulley or adjacent bend pulley. The centrifugal switches provide protection for slack or broken belts and they also provide a positive sequence interlock scheme.

Blending and loading system: Depending on the capacity of the loadout system, blending of sized products and loading into loadout bins may be controlled by the central operator located at the screening plant, or by a central operator located at the top of the loadout bins. The following description will cover a system under the control of the screening plant operator.

The sized product is blended onto a collecting conveyor by the use of vibrating feeders which are calibrated to deliver specified tonnages of material with different rheostat settings. An ammeter is provided in each rectifier circuit. The ammeters are used as a check against the rheostat settings for determining correct tonnage delivery.

A reversible shuttle belt with flop gates on each end is used for bin loading.

From the central control panel the

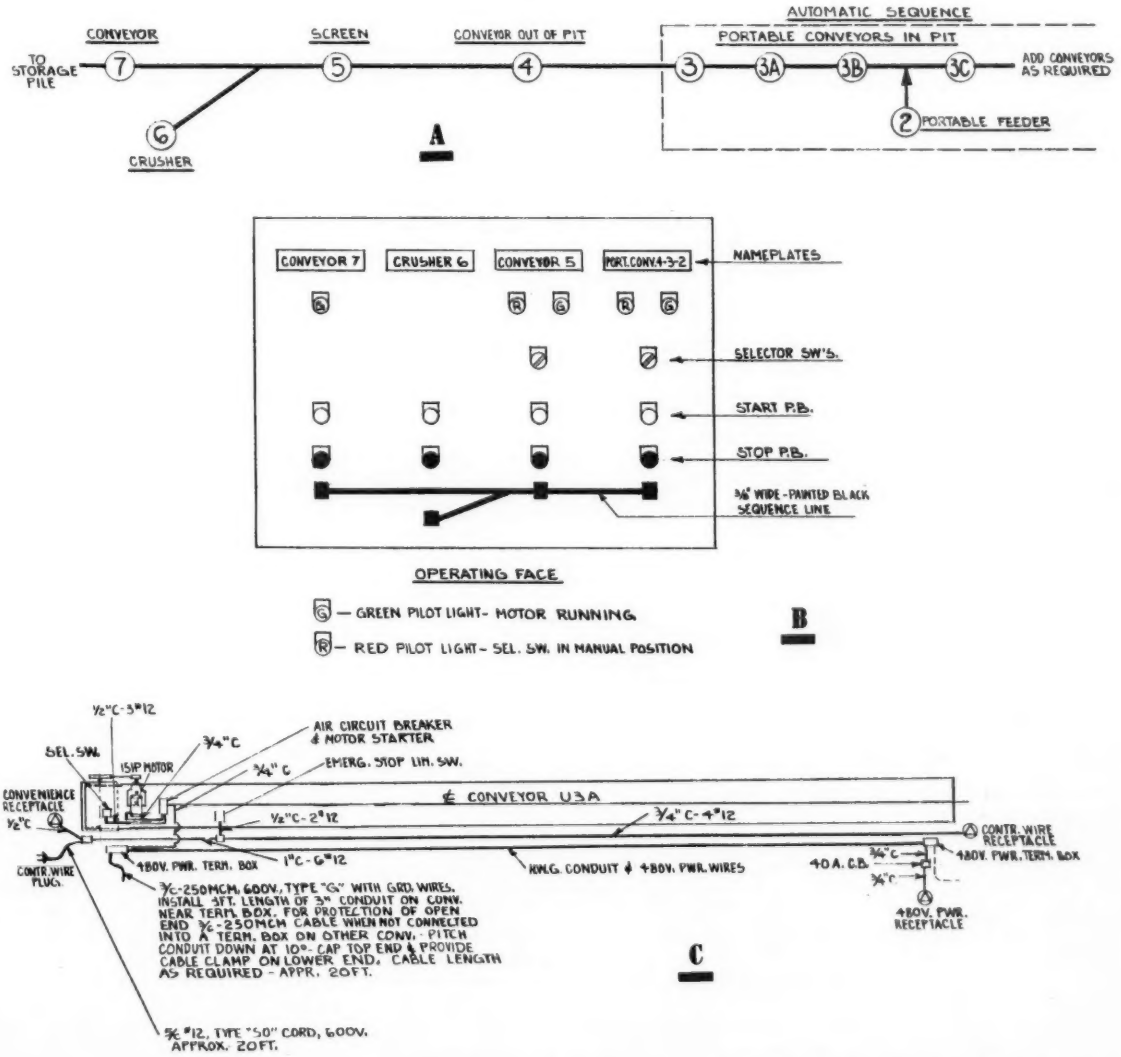


Fig. 4. (A) Sequence interlocking diagram of primary crusher and portable conveyor system from the pit (B) Central control panel for the primary crusher and portable conveyor system (C) Electrical equipment on the portable pit conveyors

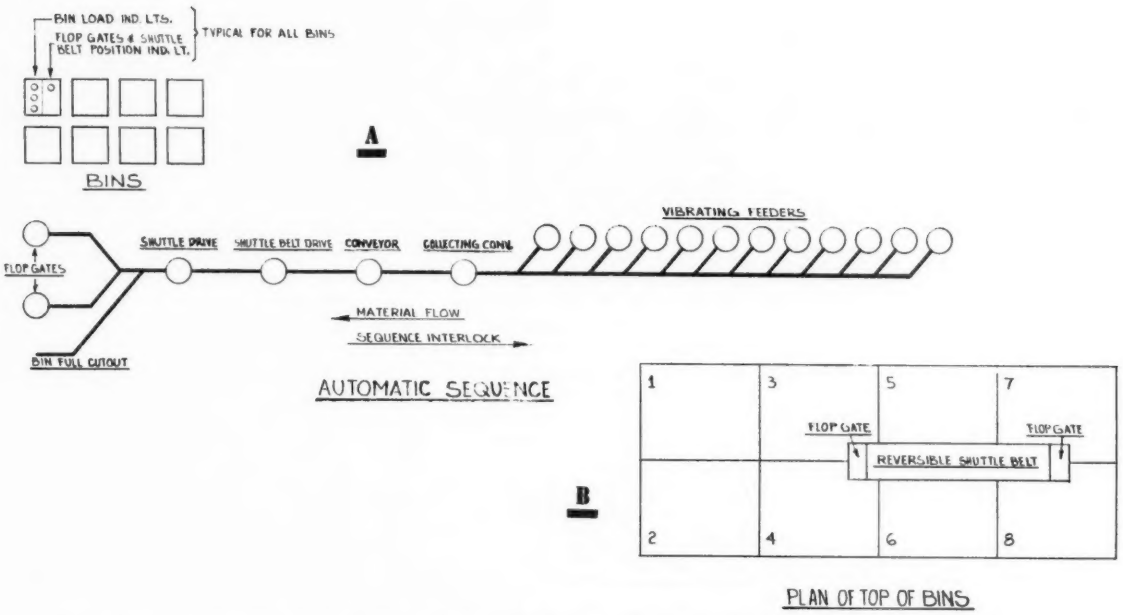


Fig. 5. (A) Sequence interlocking diagram for loading loadout bins (B) Reversible shuttle belt across top of loadout bins

operator selects the bin he desires to load into, sets his conveyors and feeders selector switches on automatic, presets his individual feeder feed rates and pushes his start button. The correct flop gate on the end of the shuttle belt positions itself, the shuttle belt positions itself at the same time and upon reaching its correct position will automatically start the belt in the correct direction. Each conveyor will automatically start in sequence back to the collector belt which will then start the feeders in timed sequence. The control panel has high, low and medium bin level indicating lights.

An emergency high level unit is provided on each bin to automatically stop loading to prevent an accidental material overflow.

Figure 5 (A) shows the sequence interlocking diagram, and figure 5 (B) shows the reversible shuttle belt across the top of the loadout bins.

Figures 6 (A) and 6 (B) show the control console for bin loading and the vertical panel with the vibrating feeder controls.

Although only a brief comment was made in the earlier part of this paper regarding a sand plant, it is worthwhile mentioning that the pumps in washing operations can be controlled by time delay devices to permit a temporary shutdown of pumps due to unbalanced water conditions without stopping the sand plant operations. These devices all contribute to a more continuous operation, prevent overflow cleanups, and protect equipment from damage.

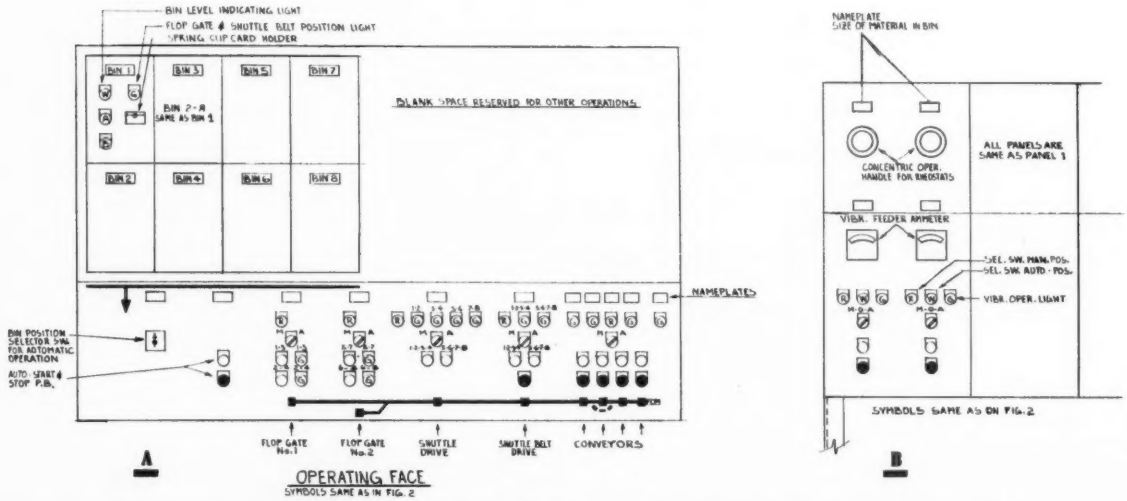


Fig. 6. (A) Central control console for loading loadout bins (B) Vertical panel with vibrating feeder controls

As Viewed by HARRY L. MOFFETT of the American Mining Congress

Congress stepped up its tempo in August in an effort to adjourn before Labor Day, but there were some indications that the first session of the 86th Congress might run a little past that date. President Eisenhower made last-minute appeals to Congress to stay in session until it completed action on key measures he termed vital to the country's welfare.

The President's request, made just before his departure on a tour of Western European capitals, emphasized legislation to remove the interest-rate ceiling on Government bonds, to increase the Federal gasoline tax, and to provide additional loan insurance authorization for the Federal Housing Administration. He also voiced his disappointment that "Congress has been either unwilling or unable to enact sound farm legislation as I have urged throughout this session."

As to the interest-rate issue, the President said "No issue of greater importance has come before this session of Congress" and that there would be a "tremendously inflationary effect" if all Federal financing were forced on a short-term basis as a result of the Government's inability to pay a high enough interest rate to sell long-term bonds.

HOUSE PASSES LABOR BILL

After months of work by its Labor Committee, the House passed in mid-August a labor-reform bill containing much more effective language than the measure approved by the Committee, substituted this language for that in the Kennedy bill approved earlier by the Senate, and requested a conference with the Senate to iron out differences. Senate-House conferees were still working at reconciliation of the two versions at the end of the month with indications that the conference version will closely approach the House bill in its terms.

Before it approved the strong (Landrum-Griffin) measure, the House rejected a weak bill backed by the AFL-CIO, despite all-out lobbying by representatives of the big union. President Eisenhower had previously endorsed the Landrum-Griffin bill, and its adoption by the House was considered a smashing victory for the Administration.

The conferees had relatively little trouble in agreeing on anti-racketeering provisions to protect the rights of rank-and-file union members, require financial reporting by unions, and insure democratic processes in union elections.

As this is written, however, the conferees had hit a snag in reconciling differences involving State jurisdiction over cases declined by the National Labor Relations Board (no man's land), organizational picketing, and secondary boycotts. However, Senate conferees have stated that they expect to resolve these questions and send the conference bill to the floors of both Houses.

STOCKPILE SALES UNDER STUDY

The Office of Civil and Defense Mobilization, boss of nearly all of the Government's inventories of strategic and critical materials, revealed last month that it is considering asking Congress for new legislation designed to make the management of these materials "more flexible and business-like"—another way of saying that it would like a freer hand in disposing of materials determined to be in excess of requirements. The agency's views were set forth in a progress report to Congress by OCDM Director Leo A. Hoegh.

Under present law, he pointed out, materials in the strategic and supplemental stockpiles cannot be sold or otherwise disposed of until the lapse of six months, during which Congress must expressly approve the disposal plan, with one exception—if the material is declared obsolescent or no longer required in any amount, Congress need not approve the plan although the six-month waiting period is still required.

Hoegh cited illustrations involving long-staple cotton and cocoanut oil to show that marketing conditions could change adversely during this waiting period. He suggested that the Government's interest would be better served if it could dispose of materials with a value of $500,000 or less without notice to Congress, and, in cases involving larger dollar amounts, the waiting period was reduced from six months to 90 days.

Of the stockpiles' estimated current market value of about $7 billion, Hoegh said, the material that might be considered excess is "between $2 and $3 billion." He added that this

Washington Highlights

LABOR: House passes strong bill

STOCKPILE: Greater sales flexibility studied

FUELS POLICY: Formation of committee sought

LEAD-ZINC: New Tariff Commission investigation

TVA: Bond bill signed by President

BARTER: House rejects mandatory provision

COAL RESEARCH: Bill awaits President's action

PREMERGER NOTIFICATION: Bills are stalled

MINING AID: House approves resolution

HIGHWAY PROGRAM: Taxes hiked

STATE TAXATION: Study ordered

estimate is subject to findings from current efforts to determine the role of stockpile materials "in relation to general war with nuclear attack, including the problem of post-attack recovery."

The proposed legislation may not be approved by the administrative agencies concerned, including the Departments of Interior and Commerce, in time for presentation to Congress until next year.

CONGRESSIONAL FUELS POLICY COMMITTEE SOUGHT

Several Senators and Representatives have introduced identical resolutions authorizing the establishment of a Joint Congressional Committee on a National Fuels Policy charged with the formulation of "a national fuels policy to assure the availability of fuels adequate for an expanding economy and for the security of the United States."

The resolutions declare that it is evident that "our inevitably increasing fuel and energy requirements" cannot be adequately met "without a national policy for the most effective utilization of these resources."

In formulating its proposals, the 16-member Committee would be required to follow over-all guidelines set forth in the resolutions. It would have to report to Congress the results of its study, together with its recommendations, on or before December 31, 1960.

LEAD-ZINC STUDIES BEGIN

The Senate has adopted a resolution requiring the Tariff Commission to make another investigation of the domestic lead and zinc industries and submit a report by March 31, 1960.

Ordered to be included in this report are specific Commission findings with regard to the current conditions of the lead and zinc mining industries and what additional import restrictions, if any (by way of increased duties or import quotas, or both), need to be imposed on lead and zinc, and alloys and semimanufactured articles thereof, "in order that the lead and zinc mining operations in the United States may be conducted on a sound and stable basis."

A short time earlier, the Commission announced that it had initiated a study of the trend of imports of various lead and zinc products not subject to present quota restrictions on metal, ores, and concentrates. In its announcement, the Commission said there have been reports from various sources that since the quotas were put into effect last October, "rapidly rising imports of lead and zinc products, said to be attributable primarily to the existence of the quotas on unmanufactured lead and zinc," are rendering the quotas ineffective.

As a result of the later Senate directive, it is expected that the two investigations will be combined.

Three midwestern zinc companies have petitioned the Tariff Commission, under authority of the escape-clause provision of the Trade Agreements Act, to conduct an investigation and hearing as to whether imports of coated and uncoated zinc sheets are causing or threatening serious injury to the domestic industry producing these articles. This investigation may also be made a part of the over-all study ordered by the Senate, but with any resulting recommendations being sent to the President.

TVA BOND BILL BECOMES LAW

After a lengthy legislative battle, the Tennessee Valley Authority has been granted authority to issue revenue bonds to finance its power expansion program.

The new Federal law authorizes TVA to issue revenue bonds up to a maximum of $750 million. Ostensibly, new TVA power service areas would be limited to a five-mile periphery surrounding territory already served, but in actual practice, transmission, resale or use of TVA power outside the agency's existing service area may be unlimited so long as such transmission, resale or use is by its distributors (municipalities, cooperatives, etc.) under existing contracts, and not by TVA itself.

The law also requires repayment of the bulk of the Government's appropriation investment in TVA at the rate of $10 million per year for the first five years, $15 million per year for the next five years, and $20 million a year thereafter until $1 billion is repaid.

HOUSE REJECTS MANDATORY BARTER

Although the House Agriculture Committee endorsed in mid-August a bill which would virtually require the Secretary of Agriculture to barter $350 million worth of surplus agricultural commodities each year for strategic minerals and materials of foreign origin, the House refused to expand the present program. Such barter currently is at the rate of about $150 million a year.

The barter issue was involved in a measure to extend the Government's authority to continue disposal of surplus crops for foreign currencies—a program which has been going on for several years. Administration spokesmen had testified at earlier hearings that expanded barter would (1) displace sales for dollars, (2) displace sales for foreign currencies, and (3) have harmful results on our relations with other free-world nations who regularly export agricultural commodities.

COAL RESEARCH BILL ENACTED

Congress has enacted legislation which would set up a three-man Coal Research and Development Commission as an independent agency of the Executive Branch of the Government. It has now gone to the White House for presidential action.

The Commission would be charged with the supervision of a five-year coal research and development program, with $2 million authorized for the first year's expenditures. It would operate independently of the Bureau of Mines, which conducts basic coal research.

PREMERGER LEGISLATION STALLED

The House Judiciary Antitrust Subcommittee decided recently to postpone until 1960 consideration of any legislation dealing with premerger notification. Thus, the bill pending in the House Judiciary Committee—a companion to a Senate measure on which hearings have been held—will not be the subject of House hearings this year.

When the decision was announced, Committee sources made it plain that there was no intention to kill the bill, but that it was felt that the session was drawing too near its close to attempt any action.

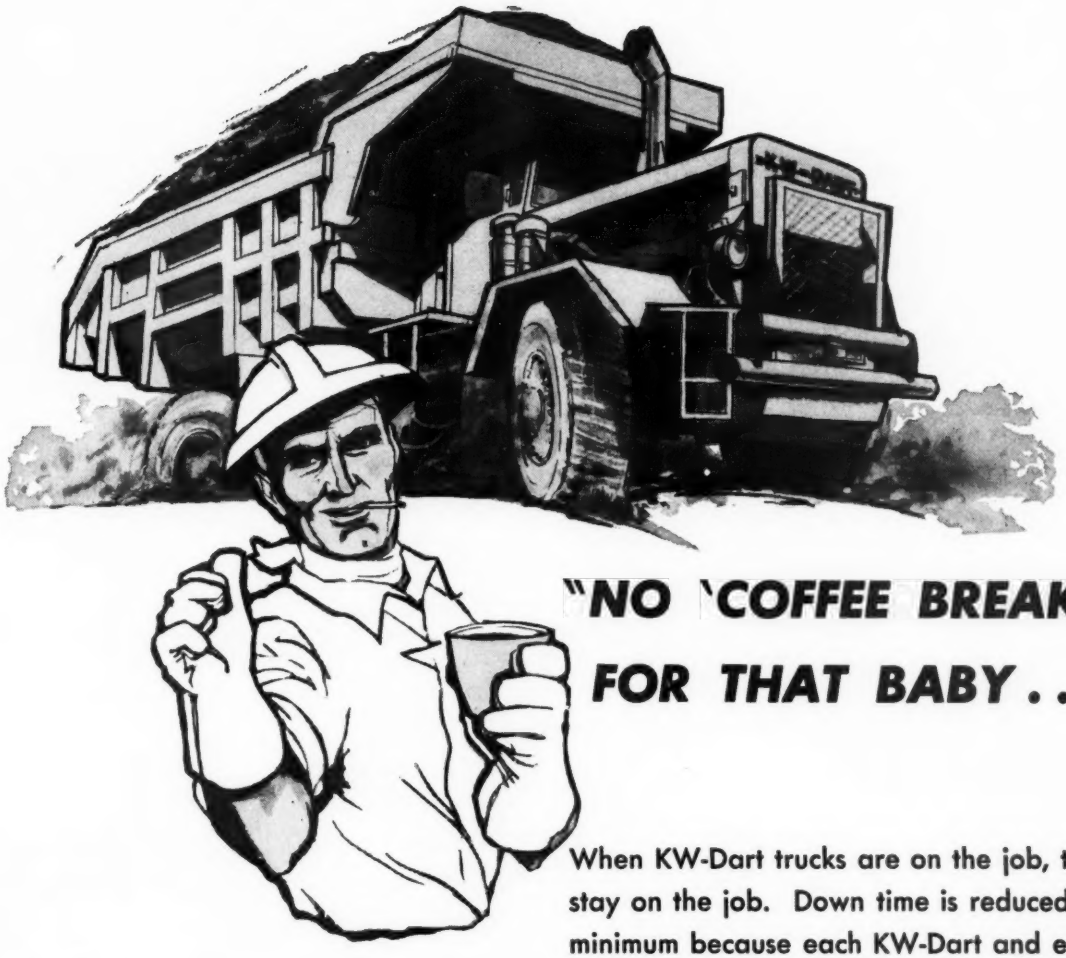
This legislation would require 60 days' advance notice to the Attorney General and the Federal Trade Commission by corporations planning mergers or asset acquisitions where the combined assets of the parties exceed $10 million.

HOUSE PASSES MINING AID RESOLUTION

Late in August the House passed a resolution which, if also approved by the Senate, would request the President to review Government minerals policies and report to Congress on steps he proposed to aid depressed branches of the mining industry.

Earlier, the House Interior Committee had recommended adoption of

(*Continued on page 81*)

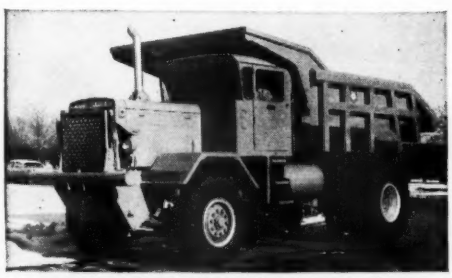


"NO 'COFFEE BREAKS' FOR THAT BABY...."

When KW-Dart trucks are on the job, they stay on the job. Down time is reduced to a minimum because each KW-Dart and each component is engineered for its specific job requirement.

KW-Dart has been building "tonnage-engineered" trucks since 1903. Performance figures, proving their rugged durability, are available for your study.

To reduce your maintenance costs and keep your trucks on the job, call for a KW-Dart engineer to consult with you.



This 25 ton KW-DART, Model 25SL, is the work horse of the KW-DART line. In use internationally in a wide variety of applications, it is known for high performance, low upkeep and economical operation.

Heavy duty off-highway and underground trucks—10 ton to 70 ton payloads.

KW-DART TRUCK CO.

Subsidiary of Pacific Car and Foundry Company

1301 North Manchester Trafficway **P. O. Box 321**

Kansas City 41, Missouri, U. S. A. 149

NEW INDEPENDENT SURVEY SHOWS HOW

ANACONDA MINING MACHINE CABLE CAN SAVE YOU 75% OF THE ORIGINAL CABLE COST!

The factual report of a well-known industrial engineering firm shows that the elimination of even one cable failure per month can result in a savings of 75% of your original cable investment.

Such significant savings emphasize the importance of choosing cable of the highest quality. Don't compromise. The few cents you may seem to save initially can turn into unnecessary high costs later. Be sure—specify time-proven Anaconda Mining Machine Cable.

Copies of the report mentioned above, on a method of determining the dollar cost of cable failure, are available to qualified users on request. For your copy, or for further information on Anaconda Mining Machine Cable, see the Man from Anaconda, or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York. 59214

See the Man from

ANACONDA®

for Mining Machine Cable

"Spotty, as a digger, you just ain't got it!"

Without realizing it, Billy has hit upon a basic truth in the excavating business. To come out on top, you've got to use the best equipment for the job.

With many factors beyond a contractor's control, choosing the right equipment becomes especially important. For this is one thing a man *can* control.

That's why so many contractors choose Bucyrus-Erie. They have learned . . . as their fathers did before them . . . that B-E machines are built for more than ordinary digging. They are built to handle the toughest jobs — and still perform better.

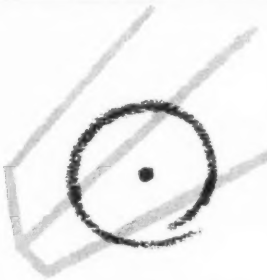
BUCYRUS ERIE

Here are the points to remember...

12M ALLOY STEEL

ESCO 12M Points are the toughest you can buy. Developed through years of research for the construction industry, cast *ESCO* 12M is carefully heat treated to produce the finest steel made for the severe shock and abrasion encountered by points and adapters.

RIGID QUALITY CONTROL TESTS ASSURE TOUGHNESS, HARDNESS



Every *ESCO* Point is Brinell tested to assure the exact degree of shock-absorbing toughness and abrasion-resisting hardness for longer digging life. Be sure to look for the Brinell mark on every *ESCO* Point you buy.

8 POINT SHAPES

You can select from eight different shapes to find the point that matches your digging conditions. *ESCO* Points are designed by bucket and excavation specialists who know how to achieve top digging performance. The self sharpening design of an *ESCO* Point makes it start sharp and stay sharp.

ESCO Points and Adapters for all digging equipment

Your local ESCO dealer can supply Points and Adapters for all your digging needs. By using ESCO Points and Adapters on all your equipment you can cut costs further by reducing your point inventory and consolidating purchases. Call your ESCO dealer today for details. He's listed in the yellow pages of your telephone directory. Or, write direct.

LITHO IN U.S.A.

ESCO Point shapes . . . start sharp, stay sharp and last longer under any digging condition.

ESCO

Electric Steel Foundry Company
2178 N. W. 25TH AVE. • PORTLAND 10, OREGON
MFG. PLANTS AT PORTLAND, ORE. AND DANVILLE, ILL.
Offices in Most Principal Cities
ESCO INTERNATIONAL, NEW YORK, N. Y. • IN CANADA: ESCO LIMITED

personals

Charles E. Schwab has been named general manager of Kellogg Operations of the Bunker Hill Co., effective January 1, 1960. He succeeds **Wallace G. Woolf,** who retires on that date.

Presently assistant to the president of Bunker Hill, Schwab is also chairman of the Emergency Lead-Zinc Committee, and has devoted most of the past two years to activities concerning the industry in Washington, D. C. Schwab joined Bunker Hill in 1944 as mining engineer. In 1948 his position was expanded to include industrial relations work as well as underground supervisory duties at Bunker Hill mine. In 1955 he was appointed manager of the Employe and Public Relations Division and became assistant to the president in 1957.

Woolf joined Bunker Hill in 1918 as a research metallurgist. He was named general manager of the company in 1955, and vice president of Kellogg operations in 1956.

Paul H. Tisdale has resigned as safety inspector with Old Ben Coal Corp. to accept an appointment as Federal coal mine inspector with the U. S. Bureau of Mines.

Stanley E. Jerome, for the past three years district geologist for Bear Creek Mining Company's coordinating unit in Salt Lake City, recently moved to Spokane, Wash., where he will be Northwest district geologist for the company.

Hecla Mining Co has announced three promotions at the Star mine which the company operates for Bunker Hill Co.

William Anderson, general superintendent for the last two years, was promoted to the newly created position of general superintendent of Hecla properties; **William Dunphy,** Star Mine foreman, was promoted to general superintendent, and **Lee Arnold** was named mine foreman.

American Zinc, Lead & Smelting Co. has announced the appointment of **R. K. Carpenter** as superintendent of metallurgy for the Electrolytic Division of its wholly-owned subsidiary, American Zinc Co. of Illinois.

The staff of the Colorado School of Mines Research Foundation has been expanded by the recent employment of several engineers. The list includes **W. Chris Spence, Manuel de Losada, Warren H. Yarroll, William P. White, M. E. Defoe, Paul Smith, Frank W. Bowdish, Harold W. Miller** and **Ross W. Smith.**

Royale J. Stevens has been appointed general superintendent of Kennecott Copper Corporation's Chino Mines Division Reduction Plant. Before his appointment Stevens had been a metallurgical and smelting specialist in the engineering department of Kennecott's Western Mining Division.

George D. Bellows has been elected a vice president of Paul Weir Co., Inc. For the past two years he has been in charge of the ferrous and nonferrous mining department of the company in Korea.

Chesapeake and Ohio Railway announced that **Fred R. Toothman** has been appointed engineer of coal properties for the company. He succeeds **G. E. Hoover,** who has retired after 18 years of service with C&O. At the same time the appointment of **Frank L. Gaddy** as mining engineer in the Coal Development Department and the promotion of **James R. Lilly** from field engineer to mining engineer were announced.

Fred A. Brinker, assistant vice president of Vanadium Corp. of America, Durango, Colo., has been named general manager of VCA's western division, succeeding **D. W. Viles** who is retiring.

A former chief metallurgist for the western division, Brinker has been associated with VCA in an engineering capacity since 1951. Viles' work with VCA has covered some of the biggest developments in the Colorado Plateau, including the properties at Telluride, the Monticello, Utah mill, the Naturita operations, and lately the Durango smelter.

H. E. Mauck has resigned as general superintendent of Olga Coal Co., Coalwood, West Va., to join Freeman Coal Mining Corp. in Chicago as vice president in charge of operations. He fills a vacancy created by the death of **F. E. Snarr** earlier this year.

H. Mauck

Mauck is a native of Illinois and began his mining career in that State. He joined Pittsburgh Coal Co. in 1939, leaving there in 1948 to join Olga as assistant to the president. He was made general superintendent of Olga in 1949.

Grover J. Holt retired July 31, from his position as assistant to the president of Cleveland-Cliffs Iron Co. He will continue as consultant for Cleveland-Cliffs, and is opening a consulting office on the mining and metallurgical treatment of iron ores.

John A. Lentz has become manager of the Morenci Branch of Phelps Dodge Corp. with headquarters at Morenci, Ariz. He succeeds **Lyle M. Barker** who is retiring from active service with this large copper porducer.

A. W. Petersen has been appointed manager of industrial relations for Penn-Dixie Cement Corp. He succeeds **A. H. Bostwick,** who retired.

James A. Williams has been appointed director of the Division of Mines & Minerals, Department of Natural Resources, for the State of Alaska.

John Ortman, geologist, formerly associated with Utah Construction Co., has joined the staff of W. S. Moore Co.

John W. Barnes, a veteran of more than 26 years in the mining and milling industries, has been appointed deputy director of the Source Material Procurement Division, Atomic Energy Commission, at the Grand Junction Operations office. For the past three years Barnes has been chief of the planning and evaluation branch of the Source Material Procurement Division at Grand Junction.

Wayne A. Pakkala, general superintendent of Cleveland-Cliffs Iron Company's Minnesota mines, has been transferred to the Cleveland office as technical assistant in the mining department.

The promotion of **George C. Horak** from instructor to assistant professor in mining engineering at Lehigh University has been announced. A graduate of the Montana School of Mines, Horak joined the Lehigh faculty in 1958.

Roy B. Young, formerly general manager of the Quebec Iron & Titanium Corp., a Kennecott Copper Co. subsidiary, has been appointed assistant general manager of the Ray Mines Division of Kennecott.

F. Vernon Tompkins has been named chief geologist for the iron ore operations of U. S. Steel Corp. near Cedar City, Utah.

John M. Hoffman has been named to the newly created post of mining manager of the Anaconda Co. He had been assistant to the vice president in charge of operations since 1958.

Drury A. Pifer, director of the School of Mineral Engineering and professor of mining engineering at the University of Washington, has been elected to the board of directors of Sunshine Mining Co., Spokane, Wash. This fills the vacancy on the Sunshine board created by increasing the authorized number of directors from six to seven.

Rex P. Lloyd, former chief of the U. S. Bureau of Mines branch in Boulder City, Nev., has been named general manager of Titanium Metals Corporation's plant in Henderson, Nev. He succeeds **Phil Maddex,** who recently resigned.

Arlan G. Potwin has been appointed assistant director of public relations for the Chino Mines Division of Kennecott Copper Corp. at Hurley, N. M.

Robert P. Tibolt, executive vice president of Eastern Gas and Fuel Associates, has been named as head of the company's Coal Division. **Charles A. Stefl,** formerly field office manager in the Pittsburgh operating department, has been appointed special assistant to Tibolt. Both men will headquarter in Pittsburgh.

—OBITUARIES—

R. A. Hummel, 72, former chairman of the board and director of the Lone Star Cement Corp., died August 6 in Milwaukee following a week-long illness.

A native of Sweden, Mr. Hummel came to the United States in 1909. He joined Lone Star in 1919 and was named president of the company in 1941, a post he retained until his election as chairman of the board in 1952. He retired as chairman at the end of 1958, but continued to serve as a director and member of the executive committee.

Mr. Hummel was active in the work of the American Mining Congress and was a member of its board of directors from 1951 to 1955.

Richard L. Bowditch, 59, died of a heart attack July 31. Former president of the Chamber of Commerce of the United States, Mr. Bowditch was chairman of the board of C. H. Sprague & Sons and Imperial Smokeless Coal. He was also president of American Coal Shipping, Inc., and A. H. Bull Steamship Co.

William W. Gamwell, 61, asstant treasurer of The New Jersey Zinc Co., died August 4. He had been associated with the company since 1948.

Roy H. Kingsbury, 82, identified with the mining industry in the Coeur d'Alene, Idaho, district for 59 years, died June 23 in a Wallace hospital. He had been in failing health since undergoing a major operation in Seattle last October.

Mr. Kingsbury came to Burke as an office employe of a mining company in 1900 and his subsequent activities covered a wide range of activities in mining and other business of the district. For a time he was purchasing agent for Federal Mining and Smelting Co. and, for a number of years prior to 1930, he was chief accountant for Interstate-Callahan Co. at the Interstate mine.

In 1931 Kingsbury organized the Wallace Brokerage Co. Through the years he had been identified with Metropolitan Mines Corp., Hypotheek Mining and Milling Co., National Uranium Corp., St. Elmo Mining Co., Aberdeen-Idaho Mining Co., Silver Star Mines Corp., and Black Bear Silver-Lead Mining Co. as officer or director.

Douglas McKay, 66, one of President Eisenhower's original Cabinet members, died July 22 in Salem, Ore., of a heart ailment and kidney complications.

Mr. McKay was Secretary of the Interior from 1953 until 1956.

Leonard E. Adams, 75, well-known Utah coal producer, died at his home in Salt Lake City July 8.

Former president of Utah Coal Operators' Association, Mr. Adams, at the time of his death, was president of Adams Black Diamond Coal Co. and Red Devil Coal Co.

E. F. Remer, 80, widely known Mesabi Iron Range mine operator, died July 28. Mr. Remer operated mines under the name of Charleson Iron Mining Co., a company of which he was board chairman. He is generally credited with being the first to introduce truck haulage of iron ore on the Mesabi Range.

Walter Hull Aldridge, 91, chairman emeritus of the board of Texas Gulf Sulphur Co., passed away August 16 at his New York home after a long illness.

Mr. Aldridge began his mining career in 1887 when he joined Copper Smelting Co. at Pueblo, Colo., as an assayer. Five years later he went to East Helena, Mont., to become manager of United Smelting & Refining Co. In 1897 he was put in charge of the Mining and Metallurgical Department of Canadian Pacific Railroad. Mr. Aldridge left Canadian Pacific in 1911 to take charge of other mining properties, serving at various times as managing director of Inspiration Copper Co., president of the Magma Copper Co., and vice president of the Mines Company of America. He became president of Texas Gulf Sulphur Co. in 1918, holding that post until 1951 when he became chairman of the board.

NEWS and views

W. Va. Properties of Truax-Traer Sold

Truax-Traer Coal Co. has announced the sale for cash of all physical properties in its West Virginia Division to Oglebay Norton Co. of Cleveland, Ohio, subject to the approval of its stockholders at a special meeting scheduled for September 28.

The West Virginia Division of Truax-Traer comprises nine operating mines with coal preparation plants at Kayford and Ceredo, together with substantial reserves of metallurgical coal. The properties are located in Boone, Kanawha, Raleigh and Wayne Counties, West Virginia. The large capacity preparation plant at Ceredo, located on the Ohio River, includes rail-to-water loading facilities.

Truax-Traer is objectively expanding its strip mining operations in the Midwest. The proceeds of sale will contribute to the further development of large coal reserves in Illinois and North Dakota to serve the increasing demand for utility and industrial steam coal. The company is actively pursuing development of mines to serve large thermal generating stations located at the mine site.

Oglebay Norton owns and operates deep coal mines in West Virginia and Ohio producing steam, domestic and by-product coals. It also acts as Sales Agent and broker for mines producing coal in Ohio, West Virginia, Pennsylvania and Kentucky.

Acquisition of the Truax-Traer West Virginia properties will supplement Oglebay Norton Company's coal reserves and operations to provide a long-range and diversified supply of prepared coals.

Iron Ore Association Elects New Directors

Three new directors were elected by American Iron Ore Association at its recent annual meeting. They were C. H. Dewey, Republic Steel Corp.; C. B. Jacobs, Inland Steel Co., and R. Q. Archibald, North Range Mining Co.

All other officers and directors of the association were re-elected, including Herbert C. Jackson, associate managing partner of Pickands Mather & Co., as chairman, and Walter A. Sterling, chairman and president of Cleveland-Cliffs Iron Co., as president.

Coal Heats White House

Senator John Sherman Cooper recently told the Senate that the Federal Government is saving nearly half a million dollars annually by heating the White House, the Capitol and other local Federal buildings with coal. He said that his information "should come as a revelation to those under the mistaken impression that bituminous coal is an old-fashioned fuel, unable to meet the demands of the mid-Twentieth Century market." Modern coal equipment and engineering dispose of combustion products which lead to air pollution, and provide "a conveniently operated, efficient, economical fueling operation," Cooper added.

Dundee Cement Kilns To Be Nation's Largest

Work on Dundee Cement Company's $25,000,000 plant at Dundee, Mich., 40 miles south and west of Detroit is on schedule. The new 20,000,000-bag cement plant expects to ship cement this October, and has scheduled full production for January.

Completed and in use at the site is a 40,000-sq ft workshop building, and well under way is a three-story underground primary crushing mill. Located beneath the floor of the limestone quarry at the site, this crusher will reduce quarried limestone to minus six in. The resulting product is to be transported from the primary crusher located 160 ft below the earth's surface, by underground conveyor belt to the secondary crusher on the surface for further grinding. Also finished are three 120-ft diam slurry basins, in which pulverized limestone will be mixed with clay-and-water "slip." The resulting slurry will then be pumped to the kilns for conversion to cement clinker.

The kilns, 16 ft to 6 in. in diam and 460 ft long, are said to be the largest in the nation. Each kiln will hold approximately 200 tons of clinker and will be turned by two 250 hp motors.

Three of the five cement grinding mills already are in place.

The new plant was conceived to be a show place for concrete construction as well as a cement producing facility. Reinforced concrete was specified by St. Lawrence Cement Company's engineering division, who designed the plant, wherever applicable; some 60,000 yd will be used in construction.

Peabody Acquires Sunnyhill Companies

Peabody Coal Co. has announced that agreements have been entered into under which Peabody will acquire the stock of Sunnyhill Coal Co. and Sunnyhill Coal Sales Co. The agreements will involve the exchange of 257,925 shares of Peabody common stock for all the stock of both the Sunnyhill companies.

Sunnyhill Coal Co. owns and operates its Mine No. 8 near New Lexington, Ohio. This is a modern strip mine producing approximately 1,500,000 tons of coal annually, utilizing large-scale equipment including a late model 65-yd stripping shovel purchased in 1958. In addition, the company owns and operates the Glen

(Continued on page 81)

US RUBBER CONVEYOR BELTS

20,000 tons of washed coal per day adds up to 40,000,000 tons

This is the minimum tonnage expected to be hauled in an estimated 12-year life by the main "U. S." belt on this conveyor system.

The system is installed in U. S. Steel's Robena Coal Mine, Uniontown, Pa. Robena is actually three mines, all serviced by the same preparation plant. This combination constitutes one of the largest coal-producing units in the nation.

A single U. S. Rubber Slope Belt (installed 1953) conveys all the washed coal, amounting to over 20,000 tons a day. A second "U.S." Belt (installed in 1951) conveys coal to the blending bins.

It's top year-in and year-out performance like this that makes U.S. Rubber the world's largest producer of belts.

The belts in Robena were designed and installed with U.S. Rubber's COORDINATED ENGINEERING... the engineers of the mine, the builders of the conveyor system, and the "U. S." Belting engineers all work in coordination to produce the most efficient and economical coal-handling system.

• • •

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

US RUBBER

Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

WHEELS OF GOVERNMENT

(*Continued from page 70*)

the resolution after six days of hearings during which many witnesses described current conditions in many mining areas and suggested possible Government action to place hard-hit segments on a sound basis.

The resolution expresses the desire of Congress and does not require the President to act.

HIGHWAY TAXES HIKED

The impending deficit in the Highway Trust Fund, which threatened to stop the interstate highway construction program entirely, was solved by Congress on a compromise basis. President Eisenhower requested a gasoline tax increase of 1½ cents a gallon, but Congress settled for an increase of 1 cent a gallon for a 22-month period ending June 30, 1961. In addition, Congress arranged for one-half the tax on passenger automobiles and five-eighths of the tax on auto parts and accessories to be transferred to the Highway Trust Fund for a three-year period. This compromise will result in a slight slowdown on the highway program.

STATE TAXATION STUDY ORDERED

Congress has enacted "stopgap" legislation to deal with the problem of States imposing income taxes on companies whose only activity within the States concerned is the solicitation of orders to be filled from out-of-state. In such circumstances the new law provides no state income tax may be imposed if the order has to be sent to the home office for approval. The law also provides for a complete study of this field in order to try to formulate reasonable rules governing the allocation of income from interstate commerce for State tax purposes.

Annual Coal Division Conference

Pittsburgh, Pa., Thursday, November 5, 1959

Representatives of all segments of the coal mining industry—including both the production and engineering departments of coal mine operations, manufacturers of mining equipment and interested State and Federal agencies—are cordially invited to attend the Annual Conference of the American Mining Congress' Coal Division at the Penn-Sheraton Hotel, Pittsburgh, Pennsylvania, November 5.

At this meeting the seven AMC Coal Division Committees will report on work that has been completed this year and the progress of current studies. The primary purpose is to advance the work of the various committees and sub-committees of the Coal Division, and to encourage the free interchange of information that is so important to advancing technology in any industry.

In their work of developing and disseminating operating and technical data, the Coal Division committees study the practical application of mining machines and methods to determine what is required for successful operation under widely varying conditions. The broad range of subjects to be covered at the November 5 meeting includes: Use of Cyclones in Sludge Recovery; Speedy Coal Analysis Procedure; An Analysis of Cleaning Plant Start-Up Problems; Pillar Extraction; Cost Controls; Employee Selection; Selection of Haulage Systems; Roof Bolt Anchorage Testing Procedures; Roof Bolt Recovery; Improvements in Design of Mining Equipment to Further Mine Safety; Trends in Off-Highway Truck Design; Stripping in Heavy Over-Burden; Legal Aspects of A-C Mining; Engineering of A-C Underground Power Systems, and Improving Temporary Splices.

Committees and their chairmen are:

Committee on Coal Preparation
JOHN J. REILLY,
Jones & Laughlin Steel Corp.
Committee on Mechanical Mining
JAMES A. YOUNKINS
Duquesne Light Co.
Committee on Mine Haulage
A. G. GOSSARD,
Snow Hill Coal Corp.
Committee on Roof Action
J. ALLAN BROOKES,
Pickands Mather & Co.
Committee on Mine Safety
RALPH E. KIRK,
Kirk & Cowin, Inc.
Committee on Strip Mining
EDWIN R. PHELPS,
Pittsburg & Midway Coal Mining Co.
Committee on Underground Power
JAMES A. ERSKINE,
Eastern Gas & Fuel Associates

(*Continued from page 79*)

Ebon preparation plant which processes approximately 325,000 tons annually of coal produced by independent stripping contractors on land leased from Sunnyhill Coal Sales Co.

Arnold E. Lamb, president of Sunnyhill Coal Co., will become Peabody's general manager of Sunnyhill mining operations.

Alcoa and British Company Form Partnership

Aluminum Company of America and Britain's Imperial Chemical Industries, Ltd., have announced the formation of a partnership to step up the already rapid growth of aluminum manufacture and use, particularly in the United Kingdom and British Commonwealth market. Subject to British Treasury approval, they plan to establish a new aluminum fabricating company, Imperial Aluminum Co., Ltd. Imperial Chemical would hold 51 percent and Alcoa 49 percent interest in the new company, which is expected to begin operations by August 1. Imperial Aluminum then would operate Imperial Chemical's expanded and modernized aluminum rolling mill and extrusion plant at Waunarlywed, near Swansea, South Wales.

Mine Heroes Awarded Carnegie Medal

Highest honor of the Carnegie Hero Fund Commission, a gold medal, was recently presented for heroism displayed in the Springhill, Nova Scotia, mine disaster. A total of 379

(*Continued on page 82*)

(*Continued from page 81*)

men took part in the hazardous rescue operations and managed to save 99 of the 174 miners trapped by an earth movement deep underground, October 23, 1958.

Because the Commission was unable to cite any individual, it decided that recognition should apply to all officials and workmen of the Dominion Steel and Coal Corp. and to doctors who risked their lives.

International Conference on Strata Control Scheduled

An International Conference on Strata Control is to be held in Paris, May 16–20, 1960. The Conference is being organized by the Centre d'Etudes et Recherches des Charbonnages de France (CERCHAR), 35, rue Saint-Dominique, Paris. Working sessions of the Conference will be held at Centre Marcellin-Berthelot (Maison de la Chimie), 28, rue Saint-Dominique, Paris. The official Conference languages will be French, English and German, with simultaneous interpreting of the proceedings in the three languages.

Because the field of strata control is very wide, the Conference is restricted to a limited number of problems, so as to ensure that these questions are examined very thoroughly. The subjects envisaged are the investigation of pressure and its effects in underground workings, and particularly the presentation of recent results obtained from: (1) laboratory experiments and (2) underground measurements and observations.

The last working session of the Conference will be reserved for the presentation of national reports, which will provide—country by country—a general statistical survey of developments and trends in roof control technique.

ALSO . . .

The Ninth Annual Drilling Symposium is scheduled to be held at Pennsylvania State University, October 8–10. With the theme "Exploration and Development Drilling," the program will cover such subjects as improving core recovery, statistics and operations research, large hole drilling and new practices in drilling.

In a new publication entitled, "A Century and a Half of Ohio's Minerals," Ralph J. Bernhagen, chief of the Ohio Division of Geological Survey, estimates that, if all the minerals extracted in Ohio since 1800 were transported in conventional railroad cars at one time, they would require a train 820,000 miles long—over three times the distance from the earth to the moon.

National Gypsum Co. plans a $125,000,000 expansion program during the next five years.

A research grant has been awarded to Dr. Fritz V. Lenel, professor of Metallurgical Engineering at Rensselaer Polytechnic Institute, to investigate powder metallurgy techniques with lead and lead alloys. The project is part of the over-all research program of the Lead Industries Association. Other investigations underway concern extrusion, lead alloys, fiber reinforced lead, lead (organic) chemicals, ceramic applications, and other special studies.

American Smelting & Refining Co. has increased capacity for production of high purity indium at its Perth Amboy, N. J., plant. There is increasing demand for the metal in electronic applications.

A study of the germanium content of 20 Kansas coals by the State Geological Survey of the University of Kansas found that germanium content ranged from 0.00005 to 0.099 percent. The present main source of germanium for transistors is residues derived from the smelting of zinc ores.

A new electric generating unit is being constructed at the Philip Sporn plant at Graham Station, W. Va. The new unit, fifth at the Sporn plant in the Ohio Valley, will have a capacity of 450,000 kw, bringing the plant's total capacity to more than 1,000,000 kw. Scheduled to go into operation July 1960, the new unit will consume an estimated 1,300,000 tons of coal annually.

Silver Hill mine, near Lexington, N. C., is being dewatered and retimbered, preparatory to operation by Tennessee Copper Co. of Ducktown, Tenn. Silver Hill has produced gold, silver, lead and zinc and was the source of lead for Confederate bullets from 1861 to 1864. It is said to have been discovered in 1838.

Stockholders of Glens Falls Portland Cement Co., Glens Falls, N. Y., have voted approval of acquisition of the company by Flintkote Co.

EMPLOYEES AT THE MILLVILLE QUARRY of Jones & Laughlin Steel Corporation's Blair Limestone Division, Martinsburg, W. Va., have worked almost 5½ years without a disabling injury. The record, which was started January 28, 1954, now extends for more than 2000 days and more than 700,000 man-hours. In the picture, Jack Cameron, Millville Quarry superintendent, holds a recently-acquired Certificate of Honor awarded by the Joseph A. Holmes Safety Association for five years of accident-free operations. Other safety award certificates on the wall are from the U. S. Bureau of Mines, National Lime Association, the Holmes Association and J&L.

(*Continued from previous page*)

Sheffield Division of Armco Steel Corp. plans to explore for iron ore in Jackson and Lafayette Counties, Mo., east of Kansas City. The division has taken options of several years length on acreage in both counties. The area was selected for prospecting as a result of an airborne magnetometer survey.

Beaufort Mining & Development Co. plans to mine tidewater phosphate in the Coosaw River area, near Beaufort, S. C., in September. New techniques and machinery are said to make the operation feasible. From the late 1870's until commercial mining came to a standstill in 1904, the deposits were mined by hydraulic dredges. Acid phosphate for commercial use was extracted by piling the raw rock in alternate tiers of firewood and raw phosphate rock and burning the rock to convert the calcium present and reduce the phosphate to an acid state.

National Gypsum Co. has announced it is increasing its Shoals, Ind., plant capacity by 50 percent to meet demands of its customers. Expansion will be completed by February 1960 and operations in the 500-ft-deep mine will then be increased to provide more ore. The plant has operated at near capacity since it was completed four years ago.

The Beryllium Corp., Reading, Pa., has formed a company with Imperial Smelting Corp., Ltd., of London, to produce beryllium metal for atomic reactors and beryllium-copper alloys used in electrical equipment. The new company, Consolidated Beryllium, Ltd., which Imperial Smelting will manage, will operate a production facility at Avonmouth, England, and sell the products in England and Europe.

Red, silver, and gold coal delivered by men in white coats has been predicted for England's fireplaces. The sprayed-on colors are said to make the coal dustproof.

Atomic Energy Commission recently announced that it is planning to set off "some" non-nuclear explosions later this summer in the Carey Salt Co. mine near Winnfield, La. The announcement said negotiations are under way with Carey for use of the 811-ft deep mine. The Louisiana test will not use nuclear materials. Instead, about ten explosions ranging up to five tons of TNT will be set off to determine whether giant blasts can be muffled enough to hide their echoes from distant listening points. One question in connection with negotiations with Russia on banning nuclear tests is whether underground shots could be detected and distinquished from minor earthquakes.

A new steel plant for Ecuador, the first in that country, is the objective of a provisional contract negotiated between Koppers Co., Inc., and Universal Mineral Resources, Inc., of New York. The plant, which would employ the recently developed Strategic-Udy process, would utilize titaniferous-iron beach sands available in Ecuador augmented by iron ore imported from Peru. Under the new contract, Koppers will proceed with the design and construction of the plant upon the completion by Universal Mineral Resources of several intermediate steps, including arranging for a continuing supply of raw material, establishing sufficient natural gas reserves for power generation, and continuing smelting tests on South American ore.

The Cement Division of Columbia-Southern Chemical Corp., subsidiary of Pittsburgh Plate Glass Co., will have a new plant in operation late this year at Barberton, Ohio, with an output of 1,500,000 bbl annually. The plant will operate on limestone from a nearby mine, using material which is too small for the company's glass-making soda ash operation.

The first shipment of copper from the Anaconda Company's El Salvador mine in Chile recently arrived at Perth Amboy, N. J. Production at this $110,000,000 mine on the western slopes of the Andes has been running at about 6000 tons per month and is expected to reach 8500 tons per month by the end of the year.

Merger of Woodward Iron Co. of Birmingham, Ala., with Alabama Pipe Co., of Anniston, became effective July 1. Woodward is a major producer of pig iron and Alabama Pipe is a large manufacturer of oil and pressure pipe. Under the merger, Alabama Pipe became a division of Woodward with Charles A. Hamilton, Jr., Alabama Pipe president, directing operations of the pipe division.

Calumet & Hecla, Inc. and Flexonics Corp., Maywood, Ill., have begun negotiations on a possible merger.

Cerro de Pasco Corp. has announced that its more than 98 percent owned subsidiary, Titan Metal Manufacturing Co., has been merged into the parent company by an exchange of Cerro stock for the few remaining shares of Titan.

New uses for mercury are the objective of a technical-economic study just begun by the American Quicksilver Institute at Battelle Memorial Institute, Columbus, Ohio. Raymond W. Hale, Battelle chemist in charge of the study, said, "We expect to generate a number of new ideas for the use of mercury—ideas for either immediate application or ideas which suggest a promising area for additional research."

The U. S. Bureau of Mines has announced it is intensifying research on beryllium and its source minerals during the 1960 fiscal year which began July 1. Under the new program, the Bureau will step up a nation-wide search for beryllium ore, build and operate a small plant for recovering low-grade beryl experimentally by flotation, and expand metallurgical studies to find ways of assuring adequate supplies of beryllium.

Tennessee Valley Authority has started to sell part of its mountains of fly ash to the newly formed Dixie Fly Ash Corp. of Tuscumbia, Ala. Material will come from TVA's Colbert steam plant. Fly ash from burned coal has been used as a partial substitute for cement in concrete for TVA's new navigation lock at Wilson Dam and additions at the Johnsonville and Widows Creek steam plants. TVA's studies show it could also be used in highway construction.

Aluminum Company of America plans to team up with Caribex Ltd. in an exploratory bauxite mining project in Jamaica. Caribex, a subsidiary of American Metal Climax, Inc., was granted a license for the project in 1957.

West Virginia Road Commission officials are taking a look at the road building material which is made from soft coal derivatives through a process developed by Curtiss-Wright Corp., Woodridge, N. Y. Kentucky has already contracted with Curtiss-Wright for construction of an experimental plant and use of the binder on various highways for testing purposes. Establishment of a similar plant in West Virginia is being considered, but meanwhile the Commission plans to obtain some of the binder for limited testing.

Florida Solite Corp., Russell, Fla., has started mining clay for the manufacture of a lightweight aggregate, which is used in structural concrete and building blocks. This is the first venture in Florida for the parent organization, Southern Lightweight Aggregate Corp. of Richmond, Va. It operates three similar plants in Virginia and North Carolina.

Kentucky will soon begin a study to find out whether a coke industry could be established successfully in its eastern coal fields. The Department of Economic Development has asked the University of Kentucky for personnel qualified to carry out the technical assignment in the least possible time. Eastern Kentucky now has two coke plants—one near Cattlesburg and another at Hellier.

The 47th National Safety Congress—annual convention of the National Safety Council—will be held in Chicago, Ill., October 19–23.

When you're talking about a $162,000 dipper shovel, you've got to talk about the best rope for it

Talking about or working with, the same thing applies. Anything below Royal Blue's performance level is simply unrealistic. Like looking for a cut-price brain surgeon.

Even at $162,000, the cost of wire rope is important. That's why so-so ropes can cost you more in the long run, because so-so ropes are *short run*. Royal Blue, on the other hand, is built by America's oldest manufacturer of wire rope to last, to do the job without a whimper. Here's why.

Royal Blue is made from the toughest rope wire ever made—Type 1105—extra high-strength improved plow steel. This pedigree gives to the rope qualities that you can't find in any other rope: exceptional resistance to shock, abrasion, fatigue and impact. Add to these a flexibility that age cannot wither nor hustling fade and you've got a collection of characteristics that make Royal Blue the strongest rope you've ever used.

A $162,000 Dipper Shovel deserves the best and your Roebling Distributor has it . . . Royal Blue. Any inquiries about this high-born rope will be answered immediately by Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities • Subsidiary of The Colorado Fuel and Iron Corporation

WANT FASTER FOOTAGE?

Step lively with Gardner-Denver air leg drills

QUALITY EQUIPMENT PLUS!

Why specify Gardner-Denver? You get more than a quality product! Skilled Gardner-Denver mining equipment specialists are always available to lend any assistance needed to insure the equipment you use is right for the job. At Gardner-Denver *there's no substitute for men*—our 100-year philosophy of growth.

Easy to use—drilling controls all grouped on back head for convenient operation.

Easy to move—lightweight aluminum alloy feed cylinder keeps drill weight down, production up . . . makes setup and moving easier.

Push-button bleed—located on "D" handle—releases air pressure in feed leg fast.

Built-in safety—exclusive, air-operated water gland automatically provides "water on, air on . . . air off, water off" drilling cycle.

Stays clean inside—constant air blowing through chuck end keeps water and cuttings from entering drill.

Hard-hitting drills—your choice of fast-acting 2½" or 2⅝" drills. Feed travels of 24", 36", 48" or 60".

Leave the leg work to Gardner-Denver air leg drills . . . see your Gardner-Denver mining specialist soon.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
Export Division, 233 Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Ave., Toronto 16, Ontario

NEWS and views

Monsanto Builds Private Road for Huge Trucks

Monsanto Chemical Co. recently opened a new private road connecting its elemental phosphorus plant at Soda Springs, Idaho, and its Ballard phosphate mine more than 11 miles away.

Constructed by Morrison-Knudsen, the roadway enables Monsanto to use special carrier units capable of hauling 75 tons of ore each trip. These units are believed to be the largest highway haulers in the country.

The 26-foot wide road is fenced on both sides. A number of underpasses along the route permit farmers to move machinery and stock from one side to the other without crossing the right-of-way. There is one bridge, which crosses the Blackfoot River.

The new road allows increased efficiency in hauling ore to the plant. Four of the new carriers will do the work of 15 smaller trucks formerly used in the operation. Each new hauling unit can make the round trip from mine to plant in about one hour.

Designed to furnish utmost operational safety, the ore truck traffic will be removed from State and county roads. Where the road crosses the State highway, and also where it crosses a county road leading to Conda, Idaho, semaphore lights have been installed which show green to public traffic. Pressure pads located on the Monsanto road 500 feet from the intersections cause the signals to turn red to highway traffic. The systems are so timed that the trucks must slow down to 15 miles per hour at the intersections to cross without stopping. These crossings were made in compliance with State highway engineers' recommendations, and afford the public optimum safety.

The route will be policed to see that all public traffic is kept off the haulage way.

The plant at Soda Springs is one of two elemental phosphorus plants operated by Monsanto's Inorganic Chemicals Division, the world's largest producer of elemental phosphorus. The other plant is located at Monsanto, Tenn.

Lignite Studies Under Way

A research program pointing toward the "marriage" of the two greatest mineral resources of North Dakota and Minnesota was disclosed recently in the signing of a contract between University of North Dakota and Great Northern Railway.

Objective of the research is development of a process in which North Dakota's vast reserves of lignite coal might be utilized to produce an economically marketable product from non-magnetic taconite iron ore. Immense untapped reserves of non-magnetic taconite exist in the western portion of Minnesota's famed Mesabi Range.

The two-year contract, under which the railway will provide an undisclosed sum for research at the University's Grand Forks campus, marks the second phase of a five-year research project authorized by Great Northern's directors in 1956, to be carried out by the Universities of Minnesota and North Dakota.

A contract was signed that year with University of Minnesota, where work is progressing on the development of a non-magnetic taconite process. While the process has not yet been definitely chosen, results have been encouraging and certain paths of approach to the large scale use of lignite have been apparent, according to officials associated with the project.

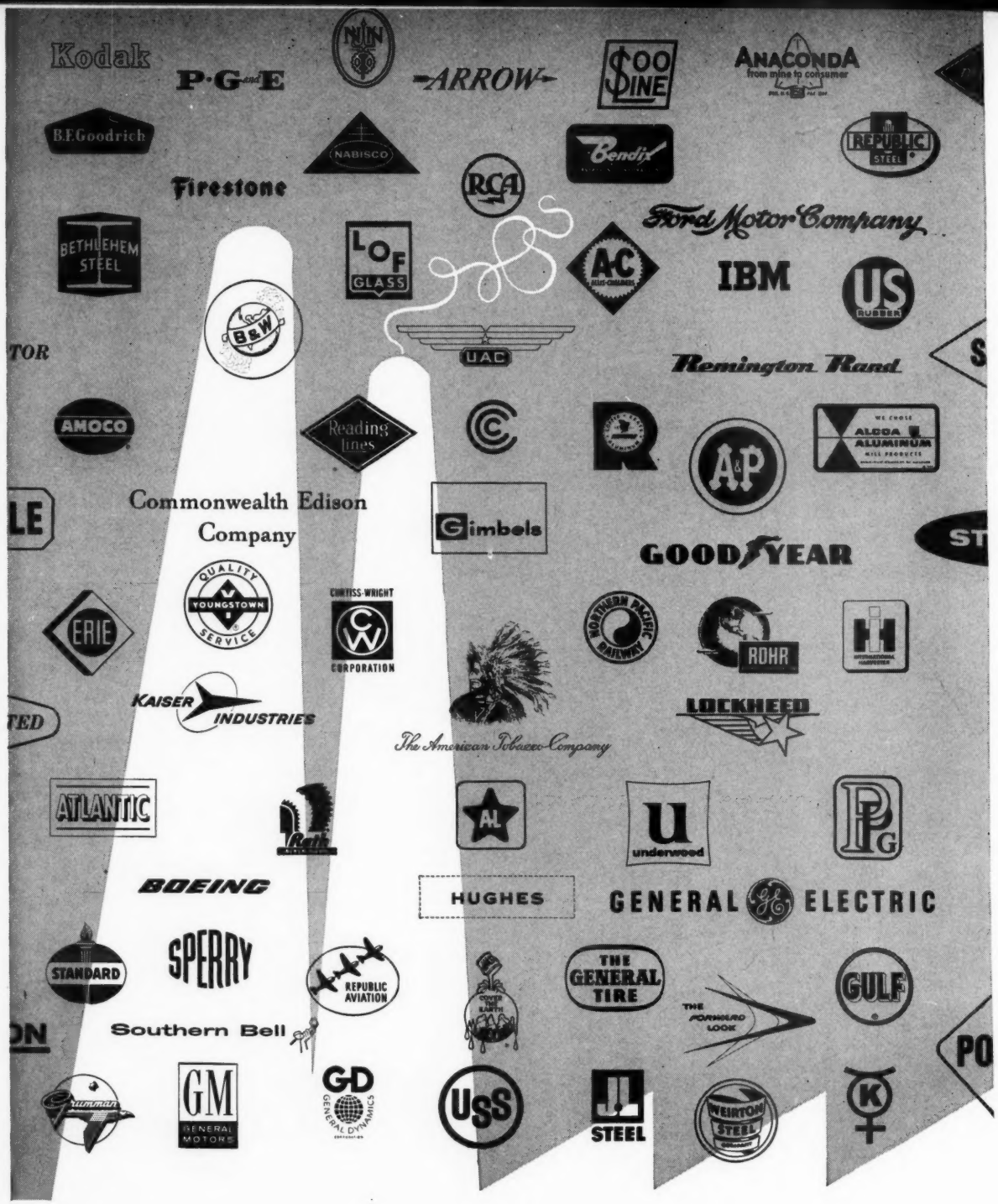
The newly-authorized lignite research will be conducted in North Dakota's Department of Chemical Engineering. The University has carried on research into the commercial utilization of lignite for many years.

Great Northern's Department of Mineral Research and Development will actively participate in the project and act as liaison with the iron mining and lignite industries.

The lignite reserves of western North Dakota are estimated at 350 billion tons—over three-quarters of the Nation's supply of lignite, or

(*Continued on page 89*)

Above is an artist's conception of the first American-made coal preparation plant to be built in India. The plant will be employed for the production of coking coal for manufacturing steel and in the production of fuel coal for electric power. McNally Pittsburg Mfg. Corp. will design and build the multi-million dollar facility, which will be operated by Hindustan Steel (Private) Ltd., an agency of the Indian government engaged in the production of steel. Scheduled to be completed in 1962, the plant is a part of India's industrialization plan to support increased production of steel and electricity in India.



LEADING AMERICAN INDUSTRIES

offer their employees the Payroll Savings Plan for U. S. Savings Bonds

These are but a few of the leading firms which support the Savings Bonds program with more payroll savers than ever before in peacetime.

The United States Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

MINING CONGRESS JOURNAL

(*Continued from page 87*)

about one-sixth of the total United States' supply of solid fuel. Although estimates vary on the extent of non-magnetic taconite in the Mesabi Range, reserves are known to be in the billions of tons.

ALSO . . .

The University of Arizona's College of Mines has received over $99,000 under a partial distribution of the estate of the late Daniel C. Jackling, internationally famous mining engineer. To be known as the Daniel Jackling Student Loan Fund, the bequest and the income from it will be used to provide loans for deserving students in mining engineering and metallurgy. Arizona's College of Mines was one of 17 institutions chosen by Jackling for the establishment of loan funds.

Jackling died in California in 1956 at the age of 86 after a career in mining engineering which took him from work as a miner and mill hand to director of mining operations of Kennecott Copper Corp. and to numerous professional awards and honorary degrees. He is credited in the industry with having developed the methods for profitable extraction of copper from the low-grade porphyries.

An amended uranium concentrate purchase agreement has been signed by U. S. Atomic Energy Commission and Uranium Reduction Co., operators of the 1500-tons per day uranium processing mill at Moab, Utah. The amended agreement extends the contract to December 31, 1966, and provides for conversion of one of the mill's acid circuits to a carbonate circuit capable of treating the high-lime ores of the district. It also provides a firm market for numerous independent ore producers whose properties hereafter are "dedicated" to the Moab mill.

In this connection, Western-Knapp Engineering Co., of San Francisco, has been awarded a $2,000,000 contract for expansion work with completion slated for the end of December.

Reactivation of the Elm-Orul-Black Rock mines in Butte, which have been closed more than three years, is planned by the Anaconda Co. Approximately 180 men will be employed when the zinc development project reaches full production in about ten months. Block caving will be used to tap ore bodies at the three mines with hoisting through the Badger mine shaft, which also has been closed since June 1956. The new project will be the third such operation in Butte.

Start-up of a new sour-gas processing and sulphur extraction plant at Okotoks, Alberta, Canada, has been announced by Texas Gulf Sulphur Co., Devon-Palmer Oils, Ltd. and Shell Oil Co., Canada, Ltd., joint owners of the new plant. Rated capacity of the new installation, which is being operated by Texas Gulf, is 370 long tons of sulphur per day.

A new company, known as Vitro Idaho Minerals Corp., has been formed to develop and mine Western Fluorite Mining Co. uranium properties in the Stanley, Idaho, area and to explore and develop new mining properties in Idaho and the Pacific Northwest. The company will have main offices in Salt Lake City. It is owned 51 percent by Vitro Minerals Corp. and 49 percent by Western Fluorite.

Ore properties near Dillon, Mont., have been purchased by North American Utilities Corporation of Canada for a reported $1,000,000 in cash and future royalties on the ore. The seller was Minerals Engineering Co., Grand Junction, which had been developing the Carter Creek properties for the past three years.

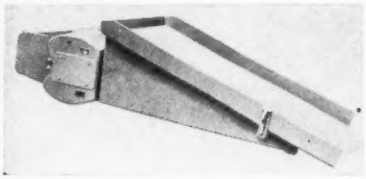
An experimental dust collector, installed at Kennecott Copper Corporation's secondary crushing operation at the Utah Copper Division Magna mill at a cost of $84,000, is being tested on recommendation by the industrial hygiene section as a result of continuous air sampling program. Designed to improve working conditions in the company's mining, milling and smelting operations, the compact collector is about one-tenth the size of comparable units and is installed directly in the duct line. Efficiency is reported to be greater than other wet-type collectors. If the experimental collector proves successful at Magna, a similar one will be installed at the Arthur mill.

Reopening of its uranium mill at Jeffrey City has been announced by Western Nuclear Corp., Rawlins, Wyo. An additional 50 men will be hired at the plant in the company's program to increase production.

manufacturers forum

Heavy Duty Vibrating Feeder

WITH A CAPACITY up to 1000 tph, the No. 6-D Feeder has been added by Jeffrey Mfg. Co., 958 N. Fourth St., Columbus 16, Ohio to its



line of electric and mechanical vibrating units. It is designed to feed controlled tonnages from bins and hoppers to belts, crushers, scales and other processing equipment.

It is equipped with 60 by 90 ft open pan deck and renewable wear resisting liner. It can be furnished with various deck styles: enclosed pan, tubular decks, grizzly type deck or with spreader-type deck.

Test Bench

A DOUBLE DUTY "Barrel Bench" supplied either as a built-up unit or in component parts for customer assembly has been announced by Schroeder Brothers, McKees Rocks, Pa. This hydraulic system test bench can be used to check repaired parts in the shop and trouble-shoot operat-

ing conditions in the field. Its advantages include the reduction of downtime of operating equipment.

The bench consists of a work table equipped with strainers, suction filter, micronic filters and drains, with which a standard 55-gal drum can be used as a reservoir. Instrumentation is provided by a portable circuit tester measuring flow, pressure and temperature. Equipped with quick disconnects, this tester may be removed from the bench and connected into the hydraulic system of the faulty equipment to pin-point defective pumps, valves or cylinders before any parts are removed. A pump drive unit, driven by either electric motor or internal combustion engine, completes the bench test assembly.

Medium Weight Dredging Agitator

DESIGNED TO INCREASE dredging production with a small initial investment, the "AGGRETATOR", has been announced by Van Gorp Mfg. Inc., of Pella, Iowa.

Its most important features are reported to be double edge teeth to cut through clay seams and allow pumping the full depth of the deposit; face and side plates which push large rocks away from suction nozzle; suction nozzle which does not need to be pulled to remove large rocks—thus increasing pumping time; easy installation, and use of existing power to drive the hydraulic motor.

Silicon Mine Power Supply

A PORTABLE silicon mine power supply, consisting of a rectifier car and transformer car, has been announced by General Electric's Low Voltage Switchgear Department. Only 30 in. high, the equipment is particularly valuable for low seam mines.

Called the "Lo-Boy" silicon mine power supply, the units are available in ratings from 300 to 750 kw, 275 to 550 volts d-c, and are designed to withstand 150 percent of rated current for two hours, or 200 percent of rated current for one minute. Regulation is said to be seven percent from no load to full load, and efficiency 95 percent.

Non-blinding Screen Deck

TO SCREEN MOIST, STICKY ores without blinding, Allis-Chalmers Mfg. Co., Milwaukee 1, Wis., has released the Inland loose rod deck for new and existing vibrating screens.

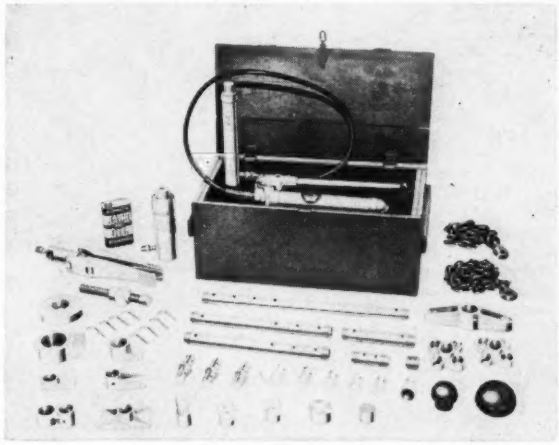
Comprised of free rolling loose rods which rotate as they vibrate, the new deck is said to increase production with reduced blast furnace fuel costs.

The loose deck rods have induction hardened ends to resist wear and abrasion. Installed at right angles to material flow in contrast to conventional fixed rod deck designs, the rods are held in place and accurately spaced by heat treated, alloy steel spacers. Replacement, singly or in groups is easy.

Rods rotate opposite to the rotation of the vibrating mechanism at 60 to 100 rpm depending upon screen throw and speed. In handling ores, wet fines adhere to the rods thereby providing a thin protective coating which reduces the clear opening between them. The smaller openings, combined with rotation and secondary vibration of the rods, screen slope, and screen throw result in a fine separation.

Life-saving Equipment

DESIGNED FOR FAST RELEASE of victims trapped in mine cave-ins, vehicle accidents, or other accidents, M-S-A Porto-Power hydraulic rescue equipment has been announced by Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa. The equipment is manufactured for M-S-A by Blackhawk Mfg. Co., Milwaukee.



Power "multiplication" of the equipment is provided by a simple combination of a hand-powered hydraulic pump connected to a hydraulic ram by means of a long, flexible hose. Manual pressure on the pump handle can produce up to 20 tons of power at the ram.

Special attachments for the Porto-Power equipment make it adaptable for many rescue problems. The long hose attachment between pump and ram enables rescuers to work up to six feet away from trapped victims. Hydraulic power eliminates the need for auxiliary units, and permits rescuers to work near gas or fumes, where cutting tools, such as acetylene torches, cannot be used.

The M-S-A Porto-Power equipment is packaged in three sets: four-ton for light duty, 10-ton for general duty, and 10 and 20-ton for heavy duty.

CATALOGS & BULLETINS

PIC-A-PUMP. *Allis-Chalmers Mfg. Co., Publications & Industrial Press Dept., P. O. Box 512, Milwaukee 1, Wis.* "Pic-A-Pump" catalog's 576 pages of engineering data are arranged for convenient selection of pumping units and materials of construction to meet specific applications. Many hundreds of pump types, models and sizes are carried, along with list prices, in this publication. It permits the reader to select the centrifugal pump best suited to his individual and specific application. The catalog will be made available only on request from Allis-Chalmers district offices or distributors for personal delivery by a company representative.

AIR VIBRATORS. *The National Air Vibrator Co., 435 Literary Road, Cleveland 13, Ohio.* Navco Air Vibrators are used for moving bulk materials through hoppers, bins, and chutes in a variety of industrial plants such as steel, chemicals, pulp and power. This bulletin describes uses and applications and includes specifications and mounting information on eight different models. Ask for Catalog 303.

DRY PROCESSING EQUIPMENT. *Sturtevant Mill Co., Park and Clayton Sts., Boston 22, Mass.* Included in this eight-page catalog are illustrations and descriptions of the new Sturtevant Pulver-Mill plus information on air separators, blenders, mixers, crushing and milling machines and granulators.

(*Continued next page*)

—ANNOUNCEMENTS—

H. Edelman

H. R. Edelman, III, secretary and member of the board of directors of **Heyl & Patterson, Inc.,** has been elected to the additional office of vice president in charge of production planning and control. **D. W. Graham** has been appointed industrial engineer for the company.

J. T. Ryan, president of **Mine Safety Appliances Co.,** has received the first Professional Manager Award of the Pittsburgh Chapter of the Society for the Advancement of Management.

Charles R. Tyson has resigned as executive vice president of Colorado Fuel and Iron Corp. and its subsidiary, John A. Roebling's Sons Corp. Tyson has resigned to become executive vice president of Penn Mutual Life Insurance Co., of which he has been a director for several years. He will remain on the board of CF&I and Roebling.

The Mining Division of **Jeffrey Mfg. Co.,** has announced several field appointments in its sales organization.

Jack Wilson, assistant sales engineer for the central Pennsylvania trading area, has been named assistant district manager, Mining Division, Pittsburgh.

Carl G. Schilbe, formerly district manager of the Salt Lake District office, was appointed apparatus sales engineer, Morgantown, W. Va. Succeeding Schilbe at Salt Lake will be **Arthur E. Shannon,** who has been with the Mining Division for the past 29 years.

Don V. Slaker, chief engineer of the dump car department at Eddystone Division, **Baldwin-Lima-Hamilton Corp.,** has retired after 33 years service with the company.

Hughes Tool Co., Houston, Tex., has organized an Industrial Sales Section to promote rock bits in mine and quarry blast-hole drilling. The section is to be managed by **Leon B. Stinson,** formerly director of sales training for Hughes and a 21-year veteran of the company.

Assistant to Stinson is **Roy M. Goolsbay,** who has been a special representative in the General Sales Department since 1947 and has specialized in drilling sales. Both Stinson and Goolsbay will maintain headquarters in Houston.

Atlas Copco A. B. of Stockholm, manufacturer of air compressors and pneumatic equipment, has announced the appointment of **Jack E. Heuser** as president of their two companies in the United States — **Atlas Copco Pacific, Inc.,** and **Atlas Copco Eastern, Inc.**

In his new position, Heuser will be responsible for coordinating Atlas Copco operation in this country. Pacific is headquartered in San Carlos, Calif., and Eastern in Paramus, N. J.

Clarence Vander Molen has been appointed general sales manager of the **Wire Rope Corp. of America.** With the company since 1939, Vander Molen has advanced to his present position from warehouse manager and district sales manager. Just before his present appointment he was assistant sales manager.

(*Continued from previous page*)

"PEAK PERFORMANCE". *Caterpillar Tractor Co., Advertising Division, Peoria, Ill.* Maximum production in rock, sand and gravel pits is described in an eight-page booklet, "Peak Performance", which shows the use of dozers, wheel tractors with scrapers and wagons, motor graders, Traxcavators, and power shovels in producing materials. Removing overburden, feeding hoppers, haul road maintenance, and loading trucks are considered. To request the booklet use its title and form number D920.

LEAD ACID BATTERY TECHNOLOGY. *Industrial Division of Gould-National Batteries, Inc., Trenton, N.J.* "Instructions and Maintenance Data" (No. GB-1896) covers all phases of battery theory, operation and maintenance.

The 36-page bulletin opens with a section on the theory of the lead acid battery, and includes captioned line drawings which clearly indicate what goes on when a battery charges and discharges. Basic information is given in such areas as specific gravity changes, and charging and discharging cycles, among other principles of battery operation. A considerable portion of the bulletin is devoted to the care and operation of batteries.

SELECTOR GUIDE IN HIGH VOLTAGE HANDLING. *S&C Electric Co., 4435 North Ravenswood Ave., Chicago 40, Ill.* A Selector Guide showing the best-suited handling tool fittings for high-voltage (2500 volts and above) power fuses, cutouts, switches, and load interrupters is featured in a new Handling Tool Bulletin (No. 823) just released by S&C Electric Co. The 12-page catalog illustrates and describes the function and construction of 15 basic tools for utility, industrial plant, and commercial building interrupting equipment.

The Selector Guide shows the suitability of each high-voltage tool for each class of equipment in terms of "good," "fair," "not applicable," and "do not use." Minimum inventory of tools can be selected depending on the equipment to be handled.

JOY SLUSHER BULLETIN. *Joy Mfg. Co., Oliver Bldg., Pittsburgh 22, Pa.* Joy medium capacity, 15 to 40-hp slushers are the subject of a new bulletin. These two- and three-drum haulers are designed for continuous heavy-duty operation. Designated Joy A and B Class slushers, they have fully self-energizing clutches and automatic brakes for operating ease. Other components include large, exposed clutch bands for cooler running, longer life and simple adjustment; simplified lubrication, and rugged, one-piece steel base. Also described are three different types of remote control systems for Joy slushers. Write for free copy of bulletin 76-J.

DISC TYPE FILTER. *Dorr-Oliver Inc., Stamford, Conn.* Entitled "The American Filter", bulletin describes the design, operation and advantages of this disc-type filter for metallurgical, chemical and industrial processing. Included are line and wash drawings and photographs of the unit, its components and several operating installations.

MULTIPLE PLATE CLUTCHES. *Twin Disc Clutch Co., Racine, Wis.* A four-page engineering summary on Twin Disc Multiple-Plate Clutches for machine tool applications has just been issued. Called Bulletin 134-C, it covers Model MTS—a single clutch—and Model MTU, a duplex unit built on a single hub. Supplementary models are also described. The bulletin contains complete specifications and dimensional data as well as schematic diagrams of each model.

FLEXIBLE COUPLING BULLETIN. *Chain Belt Co., Milwaukee 1, Wis.* Bulletin 597, a revised edition on roller chain flexible couplings, is now available for distribution upon request. It outlines the advantages that are wanted and needed from a flexible coupling including simple, all-steel construction, accommodation of angular and parallel misalignments with minimum backlash, and easy installation or removal. Information is also given on how to properly select Rex flexible couplings and illustrates installation and maintenance procedures.

GEARMOTORS. *Hewitt-Robins, Inc., 666 Glenbrook Road, Stamford, Conn.* Bulletin J-17 has been issued by Hewitt-Robin's Jones Machinery Division and contains 32 pages of technical information on horizontal and vertical mounted gearmotors with capacity up to 125 hp and a variety of output speeds ranging from 780 to 1.2 rpm. Included in the booklet is a load characteristic table for applications in various industries and different types of equipment, and a selection table arranged according to AGMA classifications.

Index to Advertisers

A. C. F. Industries Inc., American Car & Foundry Division, 2
Allis-Chalmers, 12
Anaconda Wire & Cable Co., 72-73
Atlas Copco, 7

Bethlehem Steel Co., 5
Bixby-Zimmer Engineering Co., Inside Back Cover
Bucyrus-Erie Co., 26-27, 74

Deister Concentrator Co., 45
Denver Equipment Co., Inside Front Cover, 14
Dow Chemical Co., 8-9
Dupont de Nemours & Co. (Inc.), E. I., 3

Electric Steel Foundry Co., 75-76
Euclid Division, General Motors Corp., 24

Flexible Steel Lacing, 89

Gardner-Denver Co., 86
Gerow, Theron G., 83

Hendrix Mfg. Co., 63
Hewitt-Robins, 16

Ingersoll-Rand Co., 20

Jeffrey Mfg. Co., 25

KW-Dart Truck Co., 71
Kaiser Engineers, 18
Kennametal Inc., 28

Lee-Norse, Co., 11
LeTourneau-Westinghouse Co., 15, 17
Longyear Co., E. J., 83

Marion Power Shovel Co., 22-23
Mine Safety Appliances Co., Back Cover
Mott Core Drilling Co., 83

National Mine Service Co., 19

Ohio Brass Co., 13

Pattin Mfg. Co., 84

Roberts and Schaefer Co., 6
Roebling's Sons Corp., John A., 85
Read, Davis, 83

Sheffield Steel Division, Armco Steel Corp., 21

Timken Roller Bearing Co., 4

U. S. Rubber Co., 80

Western Machinery Company, 10
Woomer & Associates, J. W., 83

ONE RESPIRATOR STANDS OUT